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The JOURNAL OF THE DEPARTMENT of AGRICULTURE

VICTORIA - AUSTRALIA

VOL. XXXII PART 2

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FEBRUARY, 1934 Price 3d.

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Issued under the direction of the Hon. J. Allan, M.L.A., Minister of Agriculture.

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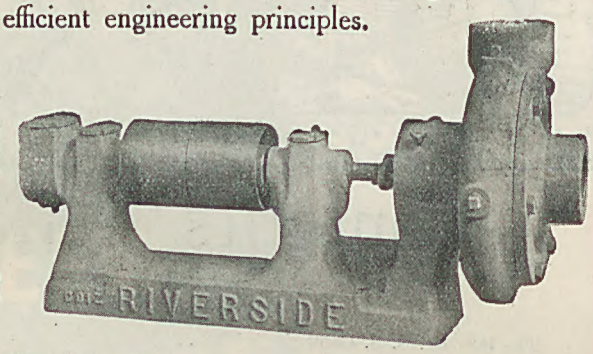

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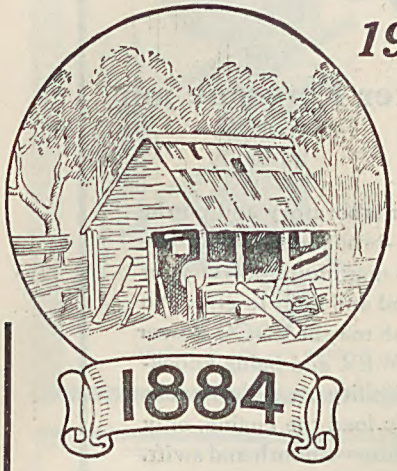

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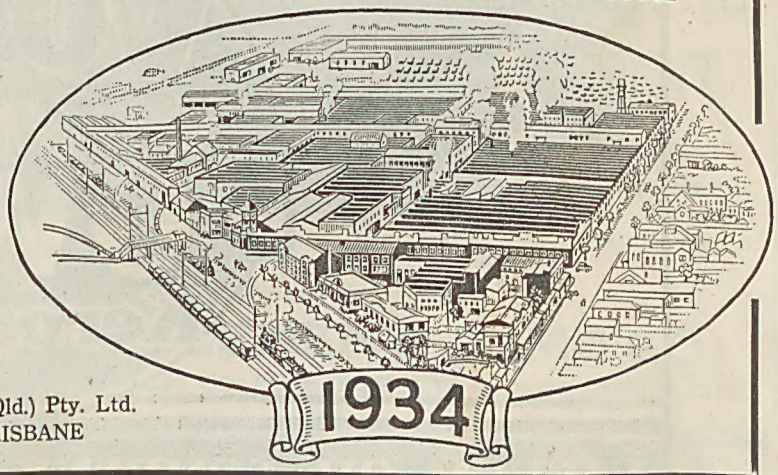

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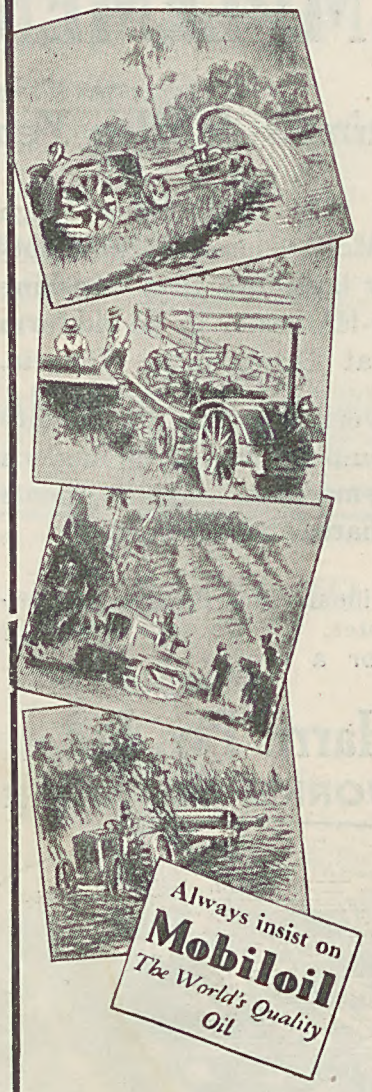

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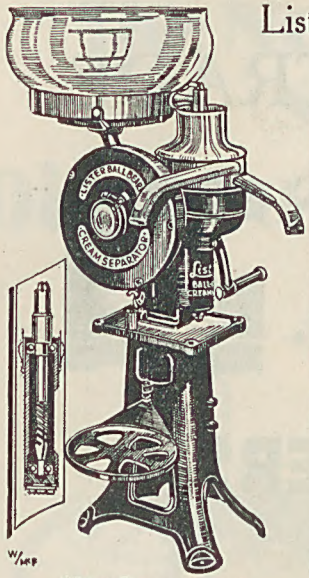

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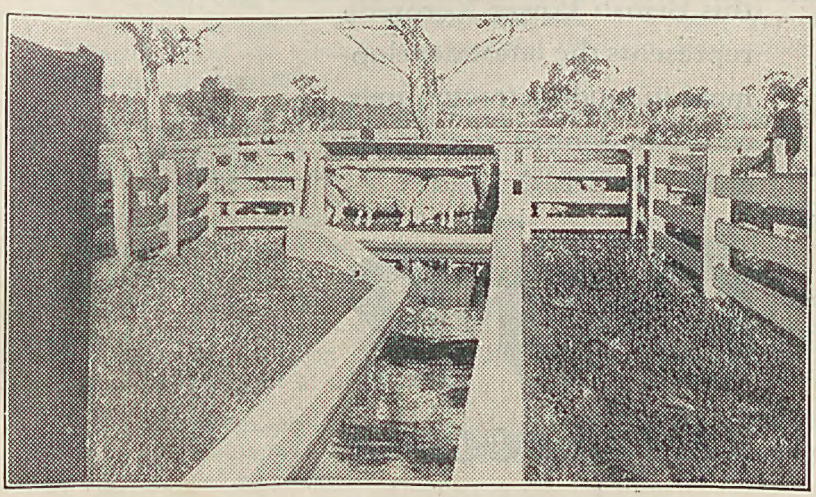

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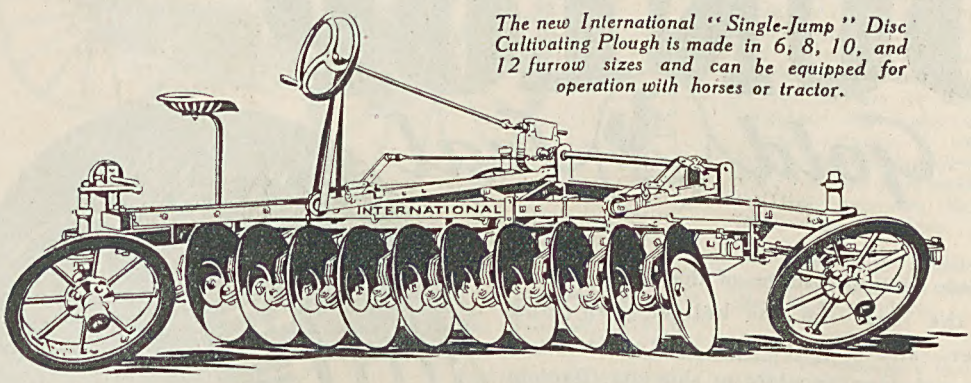

The new International "Single-Jump" Disc Cultivating Plough is made in 6, 8, 10, and 12 furrow sizes and can be equipped for operation with horses or tractor.

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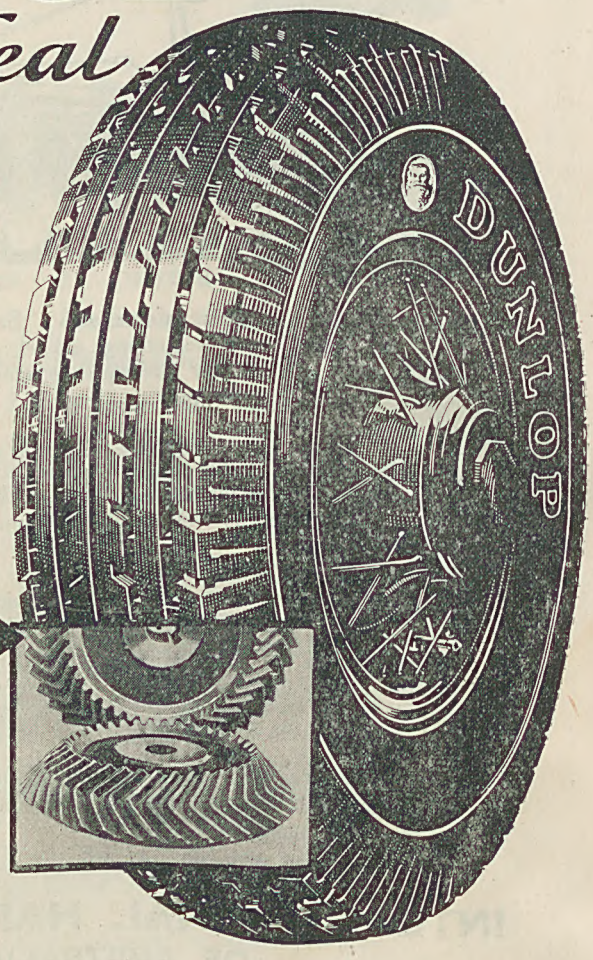

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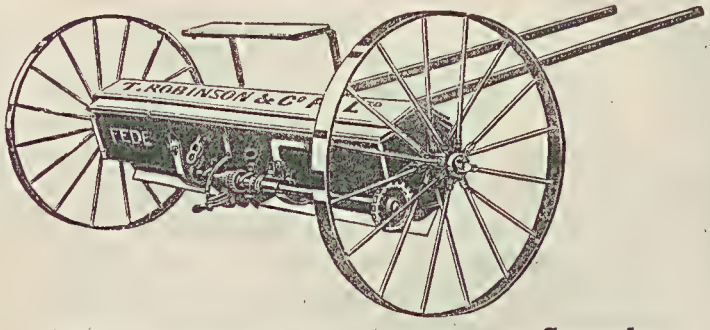

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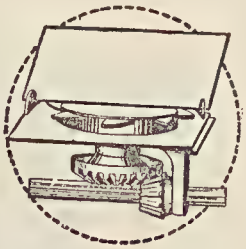

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The Late Dr. S. S. Cameron

WITH sorrow we place on record the death, on 31st December, 1933, of Dr. Samuel Sherwen Cameron, for twenty years Director of the Victorian Department of Agriculture.

Born at Cumberland, England, in 1865, Dr. Cameron graduated at the Edinburgh Veterinary College in 1888. Shortly afterwards he came to Victoria, where he accepted an appointment as Lecturer and Hospital Surgeon in the Melbourne Veterinary College, a position he occupied from 1889 to 1894. In 1895 he was appointed to a position in the Dunedin (N.Z.) City Council, where he was associated with the establishment of the first public abattoirs in New Zealand. He returned to Melbourne in 1896 as Principal Veterinary Officer of the Board of Health, and collaborated with the late Dr. Gresswell in the preparation of the Meat Supervision Act, the effect of which was to concentrate the slaughtering of meat in properly constructed and strictly supervised abattoirs. With this and subsequent legislation there was brought about a complete revolution in the methods of handling one of our most important foodstuffs.

While with the Public Health Department, Dr. Cameron was impressed with the primitive and insanitary methods under which many dairy farms were conducted, and set himself out to bring about an improvement, the result being the passing in 1905 of the Dairy Supervision Act, which has done so much to place the dairying industry of Victoria on a sound basis. When it was decided that this Act should be administered by the Department of Agriculture, Dr. Cameron was transferred to that Department, where he organized the Livestock Division and initiated the first organized attempts made to eradicate stock diseases throughout the State.

In 1911, Dr. Cameron was appointed Director of Agriculture, a position he held until he reached the retiring age in 1931. A man of strong character and outstanding personality, he early set out to reorganize the Department so that it might be of greatest use to the man on the land. Firmly convinced that, without the aid of science, progress in agriculture in Victoria would be slow, he determined that the teachings of the Department should be based, not on opinions, but rather on facts gained from carefully observed and accurately measured tests carried out by scientifically trained men. The first big task was to assure to the Department a supply of men with the necessary scientific training, and with that end in view Dr. Cameron played a prominent part in the development of the School of Agriculture at the Melbourne University, and, largely as a result of his early efforts in this direction, the Department at present has on its staff no fewer than 35 officers who are graduates in agricultural science. That he planned well is evidenced by the success that has marked the efforts of the Department in the last two decades, when, as a result of its research, investigations, and teachings, millions of pounds sterling have been added to the incomes of the farmers of this State.

Dr. Cameron had all the qualities of a leader of men. Having fixed on an objective, no difficulty was great enough to cause him to deviate from the course he had set. From those who served under him he demanded loyal service, and in return he placed the fullest confidence in his officers, who were assured always of his unfailing support.

Among the major reforms initiated during Dr. Cameron's association with the Department of Agriculture were the system of stallion registration, which has since been adopted in England, Scotland, and many of the States of America, the Standard Herd Test, grade herd testing, and many other movements designed for the advancement of agriculture. He was the moving spirit in the establishment of the Werribee Research Farm, which under his control developed from a sheep walk to the most important agricultural research institution in the Southern Hemisphere.

At the time of his death Dr. Cameron was a member of the Council of the Royal Agricultural Society, the executive committee of the Victorian Pasture Improvement League, the Clydesdale Horse Society, and numerous other organizations concerned with the welfare of the man on the land.

NATIONAL MUSEUM OF VICTORIA

Rural Legislation

New Acts Summarized

DURING last session of Parliament several Bills relating to various phases of agriculture, introduced by the Minister for Agriculture, the Hon. J. Allan, M.L.A., were passed, and a summary of the principal provisions of these Acts is supplied for the information of readers.

The Milk Board Act 1933.

The object of the Milk Board Act is to bring about the stabilization of the supply and distribution of milk used for consumption in the metropolis. The Act provides for the appointment of a Milk Board, consisting of three independent members, and the Board is empowered to determine the minimum price which may be paid to dairy-farmers for milk purchased from them for sale or distribution in the metropolis.

The determination of price is to be made at quarterly intervals, and the price is to be based on the average wholesale price in Melbourne of manufactured butter of the highest grade during the three months. But the Board, in determining the price, will also have regard to other relevant factors, including the place of delivery, and the food value of the by-products of skim milk, and the maintenance of supplies of milk to the metropolis at a uniform level throughout the year.

In order that the policy of price regulation may be effective, the Act provides also that all milk purchased from owners of dairy-farms for sale or distribution in the metropolis shall be purchased under a contract, approved by the Board, and that a dairyman distributing milk in the metropolis may purchase milk only from the owner of a dairy-farm, factory, milk depot, or from another dairyman. Any dairy-farmer who sells milk for sale or distribution in the metropolis at a price less than that determined by the Board is liable to a penalty of not more than £100, and any dairyman or milk depot purchasing milk for sale or distribution in the metropolis from a dairy-farmer at a price less than that determined by the Board is liable to a similar penalty.

The Board is empowered to reduce the number of dairy licences to sell milk by retail within the metropolis, and no new licences to such dairies can be issued under the Milk and Dairy Supervision Act without the consent of the Board.

The Hon. J. Allan, M.L.A., Minister for Agriculture

The object of these provisions, and of a further provision empowering the Board to define the area within which milk may be distributed from any specified dairy, is to

reduce overlapping and delivery costs. Compensation is to be paid to those persons whose licences are cancelled by the Board.

To provide necessary funds for the Board every dairyman or producer-retailer selling milk by retail within the metropolis will be required to make a contribution to the Board not exceeding one farthing per gallon on the milk sold by him.

In order to protect dairy-farmers against the practices of certain dairymen, who have obtained supplies of milk and failed to pay for them, there is a provision in the Act that before a licence is granted to a dairy from which milk purchased from a dairy-farmer is sold within the metropolis the applicant will have to lodge with the Minister a fidelity bond indemnifying the owners of dairy farms against the failure of the owner of the dairy to pay for milk received from dairy-farmers.

Farm Produce Agents Act 1933.

This Act amends the *Farm Produce Agents Act* 1928, which made provision for the licensing of farm produce agents, and the prohibition of unlicensed persons acting as farm produce agents. The present Act widens the definition of farm produce agent to include any person who carries on the business of purchasing farm produce other than wheat for re-sale by wholesale.

Another important provision in the amended Act is that dealing with the issue of licences. Under the previous Act a licence was issued by a Court of Petty Sessions, on an application supported by the signatures of six householders. The amending Act transfers the granting of licences to the Minister for Agriculture. The Department's officers have an intimate knowledge of the grain and produce trade, and the personnel engaged therein, and this provision will render it more difficult for the undesirable type of agent to obtain a licence. Before a licence will be granted the applicant must lodge with the Director of Agriculture a fidelity bond for £250 indemnifying vendors of farm produce against losses arising through the failure of the farm produce agents to pay for produce sold on behalf of such vendors.

There are also provisions making it an offence for a farm produce agent to charge commission in respect of farm produce which is taken over by him as a purchaser, or for a farm produce agent to issue misleading information with intent to deceive.

Dairy Produce Act 1933.

The *Dairy Produce Act* 1933 applies the principle of the dried fruits legislation to dairy products. The general principle underlying that legislation is that each producer should be compelled to export an equal proportion of his product, and thus bear a fair share of the lower prices prevailing overseas. This objective can be secured only by co-operation between State and Federal legislation.

Under the State Act the Minister is empowered to determine the proportion of dairy products that can be marketed within the State. This, by itself, would not prevent manufacturers in one State from marketing portion of their product in another State, and thus avoid exporting their proper quota. To meet this position Federal legislation will prohibit interstate trade in dairy products except under licence, which will be granted only on condition that the licensee complies with the export quota fixed by the Minister for Commerce.

The Act provides for the appointment of a Dairy Products Board, consisting of five members, to be nominated by the following:—

(1) The Minister for Agriculture;
(2) Victorian Co-operative Butter and Cheese Factories' Association;
(3) Victorian Proprietary Butter and Cheese Factories' Association;
(4) Victorian Dairymen's Association;
(5) The Minister, as representing the consumers of dairy products.

To defray administrative expenses the Board is empowered to make a levy on manufacturers of dairy produce.

After consultation with this Board, the Minister will determine the proportion of dairy products manufactured that may be sold within the State. Any manufacturer who sells a greater proportion than permitted under the quota will be liable to a penalty of not more than £500. The penalty is a heavy one, as this is the crux of the Act. However, a later clause provides that no prosecution shall be undertaken except with the consent of the Minister, on the recommendation of the Board. This is necessary, as in many cases it will be impossible for an individual manufacturer to adhere strictly to his quota, and provided he satisfies the Board that he has made the necessary cash adjustment with the voluntary stabilization body—in other words, that he has paid the difference between the local price and export parity on that portion

of those sales within Victoria which is in excess of the quota, no action will be taken against him.

The effect of this and complementary Federal legislation will be that every manufacturer will obtain his fair share of the local market, and must take his fair share of the less remunerative overseas market. The fixing of the price of butter for local consumption will remain, as at present, in the hands of the dairy trade in voluntary organization, but as the amount of butter that may be sold in the State for local consumption is fixed facilities are given to the trade to fix a higher price for local consumption than the oversea price.

This matter has been the subject of discussion between the representatives of the State and Commonwealth Governments and, as a result, a Bill on the lines of the Victorian Act has been passed in Queensland, New South Wales, and Tasmania, and the Federal Parliament has passed the complementary Commonwealth legislation.

Wheatgrowers' Relief (Commonwealth Payments) Act.

The object of this Act is to provide for the distribution of the £603,586 allocated to this State by the Commonwealth Government under the *Wheatgrowers' Relief Act* 1933. The Commonwealth Act provides that the money granted to the State shall be applied for the assistance of wheat-growers by providing for the needs of individual growers, but not, either directly or indirectly, on the basis of the quantity of wheat produced by the individual wheat-grower. It is provided also that a wheat-grower shall not be eligible to receive assistance unless—

(*a*) During the year ended 30th June, 1933, he derived no taxable income; or

(*b*) having derived such income he produces evidence to the satisfaction of the State authority that there are circumstances by reason of which it is just that he should receive such assistance.

Under the Victorian Act it is provided that claims for payment must be made on a special form, and that applications must be lodged with the Inspector of Land Settlement for the district not later than 1st March, 1934. All claims must be supported by a statutory declaration made before a justice of the peace or a commissioner for taking affidavits, and must be accompanied by an additional statutory declaration in duplicate relating to the taxable income received. Forms of application will be available very shortly at all post offices in wheat-growing districts.

The State authority constituted under the Act is the Wheat Growers' Relief Committee, which has been constituted as follows:—

Mr. J. A. Day (Department of Agriculture), chairman;
Mr. A. A. Lee (Department of Agriculture);
Mr. J. Whitlock (Treasury);
Mr. E. P. Cameron (Lands Department).

Any further information may be obtained from this committee, at the Department of Agriculture, 605 Flinders-street, Melbourne.

Fruitgrowers' Relief (Commonwealth Payments) Act.

The Fruitgrowers' Relief Act provides for the distribution of the £36,321 made available by the Commonwealth Government for the relief of necessitous fruit-growers who satisfy the State authority that they suffered losses in the export, from Australia, of apples and pears grown by them during the 1932-33 season.

The State Act provides that applications for payment must be made on the special form provided, and must be lodged with the Fruitgrowers' Relief Committee, Department of Agriculture, 605 Flinders-street, Melbourne, not later than 1st March, 1934. The special forms are now available at post offices in fruit-growing districts.

The Fruitgrowers' Relief Committee, which consists of Messrs. J. A. Day (chairman), J. M. Ward (Superintendent of Horticulture), and J. Whitlock, has been appointed the statutory authority which will consider all applications.

The Bees Act 1933.

Under this Act the *Bees Act* 1928 has been amended so as to enable inspectors to take prompt and effective measures to stamp out diseases by insisting on the disinfection of infected material, or where it is not considered worth saving, its destruction. One of the obstacles to the efficient administration of the old Act was the difficulty of locating hives and, to overcome this, the new Act provides for the registration of all persons having more than two hives, though no registration fee is to be payable by any person keeping not more than five hives.

[*Continued on page* 96.

Ball Smut in Wheat

Methods of Control

By A. A. Lee, B.Ag.Sc., Cereal Experimentalist.

THERE are three distinct smut diseases common to wheat in Victoria—flag smut, loose, flying or blow smut, and ball or stinking smut—the third being known also as "bunt." Thousands of bushels of grain are lost annually through the ravages of these three diseases. While the first two of these —flag and loose smuts—reduce the yield, the seed from infected crops does not lose anything in market value. Ball smut on the other hand, in addition to reducing the yield, renders the wheat from a badly-infected crop unfit for milling without expensive prior treatment.

The three smut diseases are caused by parasitic fungi, and in each case infection takes place by the spore or seed of the fungus germinating at the same time as the wheat grain, and growing inside the wheat plant until the disease becomes manifest later in the season. But there the similarity ends. With flag smut, the chief source of infection is from the spores or seeds of the fungus which are carried over from year to year in the soil, and although pickling the seed will control any seed-borne spores, it will not eliminate the disease because of the infection from the soil. Control, therefore, is based on the growing of resistant crops in rotation, and the use of resistant wheat varieties.

In the case of loose smut, infection takes place at flowering time, and the disease spore is actually incorporated in the grain itself, so that control by the use of a fungicide is out of the question. The only practical means of control available to the grower is to select seed from a crop or district known to be free from loose smut.

Ball smut, however, can be controlled by various seed treatments. Although in some parts of America the disease is said to be carried over in the soil, this kind of infection is unknown under Victorian conditions; and it is from the smut spores carried on the surface

Fig. 1.—One healthy (left) and two bunted ears of wheat.

of the wheat grain that infection of the crop takes place. When this contaminated seed is sown, the germination of the grain and of the spores occurs underground more or less simultaneously, and infection takes place by the entrance of the growing shoot from the smut spore into the wheat shoot before the latter comes above the surface of the soil. In the early stages of the growth of the crop, ball smut is not easily recognizable, and it is not until the ears emerge and the grain is forming that the disease may be detected with any certainty. As ripening proceeds, the chaffy scales of a smutted ear become pushed somewhat apart, because the grains have been replaced by spherical bodies containing a mass of black powdery dust enclosed in a tough brownish skin. (Fig. 1.) These bodies are known as "smut balls" (Fig. 2), and the black dust is really a mass of spores or seeds of the fungus causing the disease. At harvest time, or during subsequent handling, these smut balls, each of which may contain from 2,000,000 to

4,000,000 spores, may become broken, and the spores lodge in the crease, on the brush, or on the surface of the wheat grains. These infected grains are sown, and so the cycle continues.

It is because infection is carried on the outside of the grain that suitable disinfection of

Fig. 2.—Left, smut balls; centre, clean wheat; right, contaminated grain.

contaminated seed will control the disease. There is no direct infection from wheat plant to wheat plant in the crop at any stage of its development, hence the disease is not of an epidemic nature such as rust may be, and spores which pass through the alimentary tracts of farm animals are killed almost entirely in the process. A smut-free crop should result, therefore, from seed that has been carefully pickled.

Control Methods.

Two types of disinfection are practised—that known as "wet pickling," which is carried out with either formalin or bluestone, and "dry pickling" with various copper compounds.

In pickling with bluestone, the solution should be made by dissolving copper sulphate at the rate of 1¼ lb. in 10 gallons of water, and the time of immersion should be three minutes. The bluestone should be weighed, the water measured, and the time taken by a watch. The most satisfactory method is to pour the wheat into a perforated copper container, which is dipped into the solution in a cask or wooden vessel. The wheat is thoroughly stirred with a stick, when any unbroken smut balls will float to the surface and may be skimmed off. After the wheat has been immersed for three minutes it should be removed and allowed to drain. Precautions must be taken against re-infection, and the bags in which the wheat is to be placed should have been previously immersed in the pickle. When it is necessary to replenish the solution, a fresh supply should be made up in exactly the same way as the original solution, and added from time to time.

If a copper container is not available, the wheat may be pickled in bags. The bag should be divided into two or three portions and each butt thoroughly wetted in the solution to get rid of air bubbles, and stirred to allow the smut balls to rise to the surface. Wheat pickled with bluestone should be sown within a day, for if sowing is delayed, the effect on germination becomes much more serious.

The main advantage of bluestone pickling is that it provides the wheat with a good protection against re-infection. On the other hand, it has a more serious effect on the germination of seed than any other pickle—from 15 to 20 per cent. of the wheat usually being killed, while, in addition, the germination of the unkilled grain is retarded considerably. This is particularly serious when wheat is sown on land liable to set on the surface and for late sowing, where speedy germination is of vital importance. **For these reasons, pickling with bluestone is not recommended.**

Formalin is preferable to copper sulphate for wet pickling since it does not kill nearly so much wheat, nor does it delay germination to the same extent. The solution used is made up of 1 lb. of formalin to 45 gallons of water, and the time of immersion is three minutes. Accuracy should be observed in making up the formalin solution, and the methods as described for bluestone should be used, but as formalin gives little protection against re-infection, even greater care must be exercised in removing any unbroken smut balls. When properly used formalin is a very effective bunticide, but as the germination of formalin-pickled seed is usually retarded if it is kept any length of time before sowing, care must be taken not to pickle far ahead of seeding requirements. Formalin-pickled seed should not be sown on a dry seed bed, as an unsatisfactory germination is likely to result.

Dry Pickling.

Moistening wheat with pickling solutions has always been a troublesome and to some extent a risky process, and within the last ten years pickling with dry copper powders has largely replaced the less convenient wet methods. Tests conducted by the Department since 1925 have shown that where 1½ to 2 oz. of copper powder is applied evenly to each bushel of wheat, ball smut is controlled quite satisfactorily, except where the seed is heavily smutted—in which case it would be better not to use the wheat for seed.

Wheat pickled with copper powders germinates as quickly as unpickled wheat, and a

higher percentage germination usually is obtained—probably due to the coating of copper powder protecting the grain against moulds in the soil. There are a number of dry copper powders used for pickling, and some of these are more effective in controlling ball smut than others. However, recent legislation requires compounds for seed pickling to conform to certain standards which are based on practical experience, and field experiments conducted by the Department of Agriculture with copper compounds over a number of years. This should ensure that, in future, only good powders are available to farmers.

A mechanical mixer should be used to coat the grain, and while it should thoroughly and evenly coat every grain with powder, it should leave no loose powder with the wheat. The requirements of a good pickling machine may be summarized as follows:—

(1) It should be capable of coating each grain evenly with powder. To do this, the grain must be well shaken up in the mixing part of the machine, and the powder must be fed in at a uniform rate.

(2) It should remove all excess powder. A good sieving area is required, and it is desirable that the wheat should be shaken or run across the sieve rather than merely dragged across in a mass.

(3) It should be reasonably dustproof. A canvas apron round the outlet and over the mouth of the bag will prevent dust from rising there, and the damping of bags a day or two before pickling will prevent the powder working through them.

Dry pickling should be done in the open, as the dust, though not injurious to the health, is irritating and objectionable when inhaled. A mask or damp cloth can be used over the nose and mouth.

If any excess powder should be left on the grain, it may be necessary to sow the wheat through the oat runs. Should the cups become stiff, the application of a little kerosene will help them to run more freely. It is a good plan before starting up in the mornings to free the cups by turning the driving shaft with a spanner.

The fact that ball smut has been found recently in a number of competition crops would indicate that sufficient care has not been taken with the important operation of pickling the seed. This neglect is probably due to the fact that in recent years there has been very little ball smut in Victorian crops, and pickling has not been given the same attention as previously—being dispensed with altogether in some cases. Where dry pickling with recognized powders has been carried out carefully and efficiently, satisfactory control over ball smut should be obtained, and the treatment is so simple and relatively inexpensive that it should be used as an insurance against smut damage, even though losses do not appear imminent.

Yield trials of wheat treated with standard copper carbonate, formalin, and bluestone have been carried out over a period of years in departmental plots at Longerenong, Rutherglen, and Werribee, with the results shown in Table 1.

[*Continued on page 75*.

Wheat Pickling Trials at the State Research Farm, Werribee, showing effects on germination.
Left, untreated seed; centre, pickled with bluestone solution; right, dry pickled with copper carbonate.

Mallee Wheat Tests

Results at Walpeup

THE Mallee Research Station at Walpeup is steadily taking shape, and already a comprehensive programme of research work has been inaugurated there. In the past year an area of 46 acres was sown to various experiments, and valuable results have been obtained. Among the most important of the tests are the Wheat Variety Trials, in which the yielding capacities of the standard varieties and the most promising new crossbreds are being compared. The plots of each variety were sown at three periods, one set being sown early (2nd May), the second at mid-season (23rd May), and the third late (13th June). Because of the comparatively late break in the weather the early-sown plots had to be put in dry, but the mid-season and late plots were sown after rain. To ensure accuracy, four plots of each variety were sown in each set. The results obtained are shown in Table I.

Considering that the total rainfall from May to October was only 7½ inches, the average yield of 23 bushels per acre over the whole series must be regarded as very satisfactory. The plots were sown on new land, fallowed in 1932, and a dressing of 90 lb. of superphosphate per acre was used throughout. By early September the wheat, particularly the early and mid-sown sections, had made excellent headway, but in the final stages of the growing period extended dry weather and hot winds were experienced, and yields were reduced accordingly.

WHEAT VARIETY TRIALS, WALPEUP. 1933.

Variety.	Sown Early. (2nd May)	Sown Mid-season (23rd May).	Sown Late. (13th June).
	Bushels per acre.	Bushels per acre.	Bushels per acre.
Ranee × Gallipoli ..	29·5	27·3	24·2
Improved Gluyas × Ranee	28·2	23·3	22·8
Ranee 4 H	28·0	23·0	23·5
Sepoy	28·1	22·4	21·7
Ghurka	26·5	22·9	21·7
Free Gallipoli	25·0	23·5	21·3
Rajah	27·9	22·3	20·0
Major × Ranee ..	26·2	22·2	19·9
Nabawa	26·6	22·1	19·4
Mac's White	24·1	19·9	21·7
Waratah	24·1	20·3	17·8
Early Gluyas	24·0	19·9	17·9
Currawa	21·4	20·3	20·5
Joffre	21·2	19·8	19·7
Yandilla King	23·7	19·3	18·5
Average yield of all varieties	25·6	21·9	20·7

A feature of the tests was that the early-sown plots of each variety outyielded those sown at later stages. It is to be pointed out, however, that, although the early-sown section

had been put in under very dry conditions, the plots were not troubled to any extent by subsequent weed growth, as the site was comprised of new land practically free from weeds. The results, however, confirmed those of recent years, and emphasized that, on clean land the practice of early sowing is of advantage in the Mallee.

Visitors at the official opening of the Mallee Research Station, November, 1933.

New Crossbreds.

It is of particular interest to note that two new crossbreds, Ranee × Gallipoli and Improved Gluyas × Ranee, outyielded the standard varieties, the former giving the highest yield for each time of sowing. Both crossbreds are early-maturing wheats which, on account of their excellent appearance at the Annual Field Day, in November, attracted considerable attention. This was the first season in which the crossbreds had been tested in the major plots, and although to date they have given promising results, they will have to undergo further trials before any seed is released to private growers. The Ranee-Gallipoli crossbred may prove to be of great value as an early maturing wheat, superior to those already grown.

Of the other early-maturing wheats in the test Ranee 4H and Rajah did best, while among the mid-season to late-growing varieties. Sepoy, Ghurka, and Free Gallipoli were prominent.

TABLE II.—WHEAT VARIETY TRIALS—WALPEUP.

—	Average 8 Years (1925–33).	Average 4 Years (1930–33).
	Bushels per acre.	Bushels per acre.
Sepoy	21·5	25·7
Ghurka	21·1	25·7
Ranee 4 H	20·6	25·4
Free Gallipoli	20·3	24·2
Currawa	20·0	24·6
Joffre	..	24·3
Nabawa	..	24·1
Rajah	19·7	23·7

The average results of trials conducted at Walpeup for the past eight years (mid-season sowing) show that the standard Mallee wheats, Sepoy, Ghurka, Ranee 4H, and Free Gallipoli have given slightly better yields than the other varieties under test. The average yields are set out in Table II.

In addition to the variety trials described above, a further test with promising new crossbreds and leading wheats from other States was initiated on another site at Walpeup last year. Eight wheats were included in the test, with mid-season sowing (23rd May), four plots being sown in each case. The yields obtained were as follow:—Bencubbin, 24.9 bushels per acre; Free Gallipoli, 24.4; Ranee 4H, 23.9; Bobin, 23.2, Ranee, 22.6; Mac's White-Glencope, 22.1; Currawa-Indian E.-Telford's, 21.8; and Ranee-Rajah, 21.2.

Bencubbin, a leading wheat from Western Australia, headed the list, being slightly ahead of Free Gallipoli. Another important result was that Ranee 4H, the new selection of Ranee, outyielded the old strain of Ranee by 1.3 bushels per acre.

Manurial Trials.

The wheat-manurial trials, which were laid down to furnish information as to the most profitable dressing of superphosphate for general use at Walpeup and comparable Mallee districts, were designed to ascertain the effects of the manure on wheat sown at different periods. The amounts of superphosphate tested against no manure varied from 30 lb. to 120 lb. per

acre, each treatment being applied to Ranee 4H wheat sown at three stages in the cropping programme, namely early (1st May, sown dry), mid-season (22nd May), and late (13th June. The plots were sown on new land, fallowed and cropped for the first time, and were laid out in blocks replicated four times to obtain accuracy. The yields were as shown in Table III.

TABLE III.—MANURIAL TRIALS—WALPEUP, 1933.

—	Early Sown. (1st May).	Mid. Sown (22nd May).	Late Sown (13th June).
	Bushels per acre.	Bushels per acre.	Bushels per acre.
No manure	19·9	18·9	13·7
Super. 30 lb.	23·3	21·6	19·6
„ 60 „	25·1	22·4	22·0
„ 90 „	26·4	23·5	22·6
„ 120 „	27·3	24·6	23·8
Average yields ..	24·4	22·2	20·3

The results of these tests furnish further evidence on the importance of early sowing on clean fallowed land in the Mallee, as in each particular manurial treatment the early-sown plots gave the highest yield, and the returns gradually decreased as the sowing was delayed. This extra return obtained in each case from early sowing was gained without any additional cost. For example, the early-sown plots treated with superphosphate at the rate of 90 lb. per acre yielded 26.4 bushels, an increase of 3.8 bushels over the late-sown plots receiving the same dressing.

The average of all plots in the early-sown section was 24.4 bushels per acre, as against 22.2 bushels in the mid-season, and 20.3 bushels in the late-sown area.

Another feature of the experiment was that substantial increases in yield resulting from the use of superphosphate were recorded throughout the whole series. The extra yields obtained over the no-manure plots are set out in Table IV.

These figures show that at each time of sowing the response from the superphosphate consistently increased as the manurial dressing became heavier. For example, in the early-sown section the extra yield rose from 3.4 to 7.4 bushels per acre as the manure increased from 30 to 120 lb. per acre. The greatest response to the fertilizer was recorded in the late-sown section, where the increased yield ranged from 5.9 to 10.1 bushels per acre. The advantage of sowing superphosphate with the wheat became more marked as the cropping season progressed. It is not to be expected, however, that lateness of sowing may be offset merely by adding more manure.

TABLE IV.—INCREASED YIELD FROM SUPERPHOSPHATE—WALPEUP, 1933.

—	Super. 30 lb. per acre.	Super. 60 lb. per acre.	Super. 90 lb. per acre.	Super. 120 lb. per acre.
	Bushels per acre.	Bushels per acre.	Bushels per acre.	Bushels per acre.
Early sown ..	3·4	5·2	6·5	7·4
Mid sown ..	2·7	3·5	4·6	5·7
Late sown ..	5·9	8·3	8·9	10·1

Manurial trials have been conducted on good red sandy loam at Walpeup for the past nine years, and during the currency of the trials it has been found that seasonal conditions affect the degree of the responses, emphasizing the importance of long continued experiments as a guide to practice.

The average yields obtained during the nine years period are shown in Table V., together with the extra monetary returns per acre due to the use of the fertilizer.

TABLE V.—WHEAT MANURIAL TRIALS—WALPEUP.

Average Results for Nine Years.

—	Average Yield 1925–33.	Increase Due to Super.	Value of Increase at 2s. Bushel.	Cost of Super. at £5 per ton.	Extra Returns per acre due to Super.
	Bushels per acre.	Bushels per acre.	s. d.	s. d.	s. d.
No manure ..	15·0	..	..	..	..
Super. 30 lb. ..	18·0	3·0	6 0	1 4	4 8
„ 60 „ ..	19·5	4·5	9 0	2 8	6 4
„ 90 „ ..	20·5	5·5	11 0	4 0	7 0
„ 120 „ ..	20·8	5·8	11 7	5 4	6 3

These results indicate that, even at present day price levels, under conditions similar to those at Walpeup, the most profitable dressing for wheat grown on fallowed land is approximately 90 lb. per acre.

Potato Growing in Victoria

No. 7.—Planting

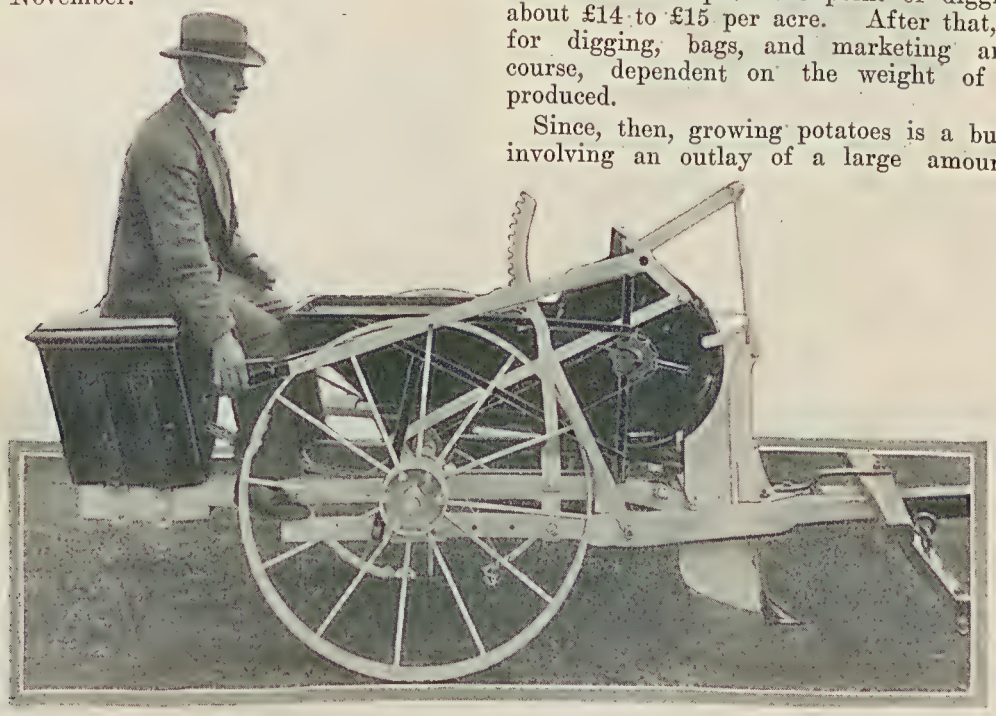
By J. T. Ramsay, Potato Expert.

Previous articles of this series, which appeared in the March, April, May, July, and December, 1933, and January, 1934, issues of the Journal, dealt with the condition and selection of seed, seed storage methods, change of seed, plant food requirements, the use of artificial fertilizers and preparations for planting.

THE planting of the potato crop in Victoria extends over a considerable portion of the year. Commencing as early as June, in districts favoured with a mild climate, a succession of plantings continues without a break from June to December, and in the case of very late districts even into January. The major portion of the acreage, however, usually is planted during the period extending from the middle of October to the end of November.

That there is still a good deal of slackness or carelessness amongst potato-growers is rather surprising in view of the fact that the potato is one of the most expensive crops to produce. As a rule, the land is high priced, and the cultural operations necessary for the maximum and complete development of the crop are such that they cannot be given without the expenditure of much time, labour and money. It is estimated that the average cost of production up to the point of digging is about £14 to £15 per acre. After that, costs for digging, bags, and marketing are, of course, dependent on the weight of crop produced.

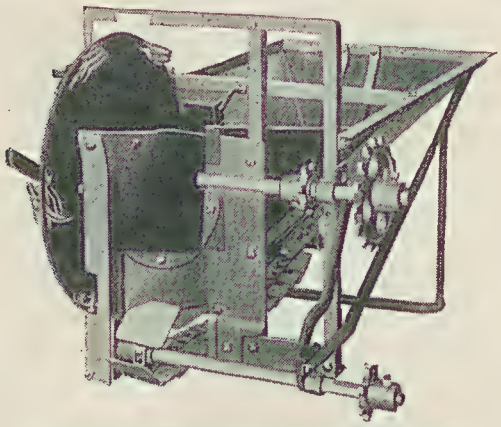
Since, then, growing potatoes is a business involving an outlay of a large amount of



An Australian made potato planter.

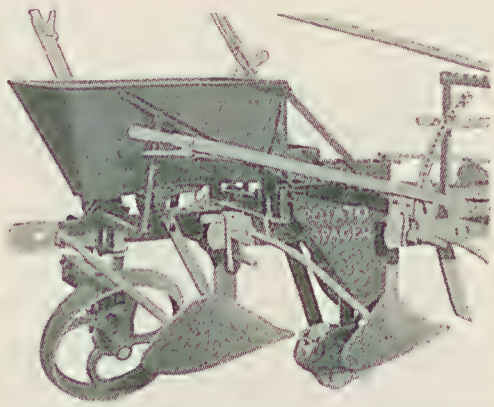
capital, it is necessary that the planting of this crop be carried out in such manner as will give it every opportunity of a successful start. The necessity for thorough preparation has been stressed previously.

The actual planting, for the most part, is done by hand, though a fair percentage of the Victorian crop is seeded with mechanical planters. Both methods are efficient. With hand planting it is advisable, first to run the harrows over the fallow to be sown so as to produce an even surface in order that the plow may work at a regular depth. It is not advisable to harrow more than a day or so ahead of planting, as, in the event of rain setting in, the soil, worked down finely by the harrows, is liable to become baked on the surface. The sets should be placed on the plowed land side of the furrow, as there they are not only in loose soil, but also out of the way of the horses' feet, when covering is being done, and less liable to injury from this source.



The seed hopper and planting mechanism.

The single, double, or treble furrow plow may be used, the last, of course, being the one most commonly employed. An excellent combination, however, is a single and a double furrow plow working together. This outfit is really better than the treble furrow plow, one of the main reasons being that the furrow in which the potato sets are placed need not be opened until planting is actually ready to be done. This is important when weather conditions are dry and warm. If the planting furrow is left open for even the space of time of the lunch hour, on a warm day, the crop resulting there invariably is lighter than in the adjoining rows.

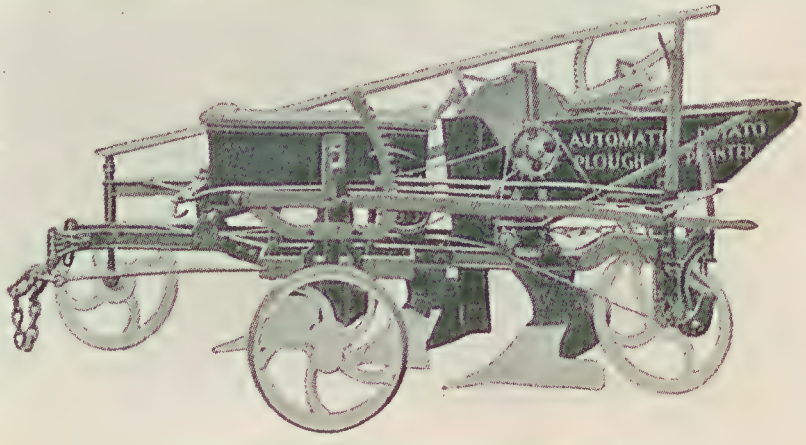


Planting attachment for double-furrow plough.

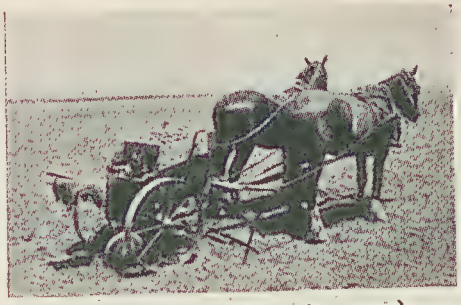
Manuring.

In practically all cases some manure should be given to fortify the natural fertility of the soil. This question has been dealt with in a previous article (*Journal of Agriculture*, December, 1933) in which the fertilizer dressings recommended for various districts were outlined.

Where manures are applied they should in all cases be placed in the furrow with the seed. Numerous tests have shown that placing the manure in close proximity to the seed sets produces a crop invariably heavier than when the fertilizer is broadcast prior to or after



Planting attachment for three-furrow plough.



A popular planter (American type).

planting. Research work has shown that the potato plant takes up plant food much more rapidly in the early stages of its growth than it does later. This fact emphasizes the advisability of having the manure close at hand to supply the needs of the crop immediately its root system commences to develop. If the fertilizer is broadcast and harrowed or plowed in, a great percentage of it is distributed at such a distance from the sets that considerable root growth must be made before contact with the fertilizer is made. Consequently, rapid growth of the young plants is not possible, and the crop suffers a handicap which it can never subsequently overtake.

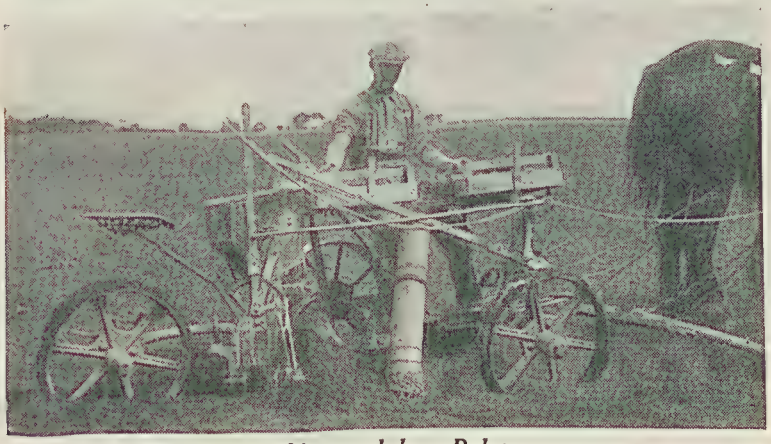
Depth of Planting.

Another factor of importance to be considered is the depth at which the sets are placed in the soil. The potato is a sun plant, and the shallower it can be grown the better. It revels in a combination of sunlight and moisture. The habitat of the original wild potatoes from which all improved and commercially grown varieties have evolved is in the tropical belt of South America. Under tropical conditions there is, of course, an abundance of summer rain. The fact that the potato is a moisture-loving plant, and remembering the actual natural environment to which it is indigenous, makes it easy to comprehend that the governing factor of the depth at which it should be planted is the shallowest depth at which it can be assured of the requisite moisture for its needs. Now, subtropical and temperate zones, in which the bulk of the world's potato crops are produced, are not subject to the superabundance of rainfall of the tropics. Therefore, in these zones deeper planting to ensure a supply of moisture for the crop is necessary. Indeed, in these zones, especially in the more southerly

Rear View of American type planter.

parts of Australia with its heavy winter and light summer rainfall, reliance has to be placed on cultivation to conserve moisture precipitated in winter in order to augment the meagre rainfall during the season of the year in which the crop is grown.

For the average local conditions prevailing in Victoria the best depth of planting is at from 4½-5 inches. Under normal weather conditions the maximum yields per acre are obtained from seed sown at about that depth. With machine planters there is always a danger of planting the sets at too shallow a depth. The ridging done by the covering discs of these machines is apt to deceive the grower. If any difficulty is experienced in getting down to 4½ or 5 inches with the machines, a good plan is to precede the machine planter



Planting machine used by a Dalmore grower.

with a spring tooth cultivator set to full depth. By its loosening effect on the soil, this operation will permit the mechanical planter to bury the sets at the desired depth of 4½-5 inches.

Cutting Potatoes for Seed.

The cutting of potatoes to be used for seed is essentially a question of economy. Where only large tubers are available for planting, it becomes necessary to subdivide these in order that they may provide a greater number of sets, and so keep down the cost of seeding per acre. In subdividing or cutting these, however, many growers go to extremes and slice up the tubers into pieces which are too small. Where this is done, the crop is handicapped at the outset. The question may be asked—What is the best-sized set? Before a direct answer can be given to this, several factors have to be considered. The first of these is the vigour of the seed parcel. Seed of weak constitution will not stand as much cutting as seed which has been selected out of a healthy and prolific crop.

Undoubtedly two of the main reasons for varieties of potatoes so quickly degenerating to a level at which their cultivation ceases to be profitable are that practically no selection of seed is made, and the seed used is too severely mutilated by the cutting knife. The second factor is the moisture content of the soil in which the seed has to be planted. Extremes of moisture and dryness are certain causes of "misses" when small-cut sets are used. Therefore, unless the soil is in a nice condition of moisture, either whole or fair-sized cuts should be planted.

A third consideration is the fertility of the soil. If the fertility and physical condition be good, the use of small-sized sets is permissible. The following comments and recommendations are based on the assumption that normally good potato land in a good state of tilth is to be planted, and that a parcel of potatoes made up of seed and marketable sizes is available for the planting.

In the first stages of growth the shoot or shoots produced from the seed set are entirely dependent on the nourishment they derive from the seed set. It is obvious then that larger sets can give a better start to the crop than can small sets, simply because they contain a greater amount of the essential nourishment for the first growth. In no circumstance should tubers of less than 1¼ oz. be used as seed for a field crop; in fact, seed of less than 1½ oz. weight should not be used if the soil and the seed are not in the best of condition.

In cutting large tubers care should be taken to see—first, that at least one good eye is left on each section; second, that the sections cut are as uniform in weight as possible and not less than 1½ oz. in weight (so much the better if they are from 2½ to 3 oz.); third, that portions showing weak buds are discarded.

A fairly common practice of some growers is to rub off all sprouts which may be growing from the tubers at the time of planting. This is a certain error. By doing so, the seed tubers are set back for some weeks in their growth, and are devitalized to the extent of the nourishment which they had expended in producing the destroyed shoots. It may be contended that the shoots are sometimes too

Method of cutting tubers over whole seed size.

The potato on the left of the top row weighed 3 oz.; the second from the left, 5 oz.; the third, 6 oz.; and the fourth, 9 oz. The potatoes on the bottom row weighed 2½ oz., 1¾ oz., 1½ oz. and 1¼ oz. respectively, and were too small for cutting.

long to permit the tubers being handled without breaking them. If the tubers have long shoots growing from them, they are merely giving ocular demonstration that the grower's system of storage is very much at fault, and this should urge him to the adoption of the system of storing his seed in proper seed potato boxes.

It is advisable that when cut the seed be placed in the ground as soon as possible. It is courting failure to cut and store it for some days before planting. The results of hundreds of tests prove that seed planted on the same day as that on which it is cut gives the heaviest yield. Dusting lime, ashes, or sulphur on the seed to dry the wound caused by cutting is not necessary, as the ruptured starch cells quickly dry on exposure to air. Sulphuring at this stage may have some advantage, not as a drier but on account of its fungicidal action. In this capacity, however, it cannot be as effective as spraying the growing crop.

Provided that the tubers used for seeding are normally healthy and are cut into pieces of equal weight, no section of the potato has superior vigour to another, i.e., stem ends and terminals are of equal value, weight for weight. The number of eyes on each set is of minor importance—it is the size of the set that counts.

Spacing of Rows.

Not less than 12 cwt. of seed per acre should be used, and this quantity could with advantage be increased to 15 cwt. to 16 cwt. per acre.

For general practice, the spacing recommended is 27 inches between the rows and about 14-16 inches between the sets in the rows. If planting is done at these distances, and 2 oz. is the average weight of the sets, approximately 16 cwt. of seed per acre will be required for planting. This is not too much. Experienced potato-growers have found that it is sound business policy to use fairly heavy ratings of seed per acre and to manure liberally.

Early varieties such as Carman No. 1 and Manistee may be placed 14 inches apart in the rows. In the case of late varieties, like Late Carman, Up to Date, and Snowflake, the spacing may be increased to 16 inches. The reason for these differences in spacing between early maturing and late maturing varieties is that the early varieties as a rule produce smaller topped plants, and do not require so much room for development as do the large-topped late varieties.

During the past twenty years the writer has judged many field crops throughout the State, and has found almost invariably that the winners on points of quality and weight of tubers have been growers who practised close planting. The results obtained from trials conducted some time ago by the Ministry for Agriculture for North Ireland so emphatically confirm the soundness of the practice of close planting which has been very strongly recommended by this Department, that they are worth quoting here. The test was carried out on three plots, for two years, the sets being planted at distances of 10-15 and 20 inches apart in drills 27 inches wide. The results were as follow:—

	tons	cwt.	
10 inches between sets ..	16	17	per acre.
15 " " " ..	13	4	" "
20 " " " ..	11	19	" "

A feature decidedly in favour of close planting was that the tubers produced were invariably more uniform in size and shape and more attractive for marketing purposes than where thinner planting was adopted.

While it is not advocated that, in general potato-growing in Victoria, potatoes should be planted so close as to allow only 10 inches between sets in the rows, this spacing could be approximated with advantage by growers for the earliest market (about August-September). These very early crops are generally grown in soils of a light character—sandy to loamy soils—which are fortified, either naturally or artificially, to a high standard of fertility. The higher the fertility of the soil in which the potato crop is grown, the closer the planting should be. For late crops grown in heavier soils, planting should be at wider spacings on account of late varieties growing large tops, and consequently requiring more room for development. The practice common amongst growers of late varieties, however, of spacing out their sets to 18, 20, and even 24 inches between them in the row is merely waste of ground. There is no justification for wider spacing than 15 or 16 inches between the sets of late varieties. A distance of 27 inches between the rows, which equals 29 rows per chain, has been proved to give ample room for horse cultivation in the heaviest ground, and this could with advantage be reduced to 26 or even 25 inches on fairly level country of medium to light texture.

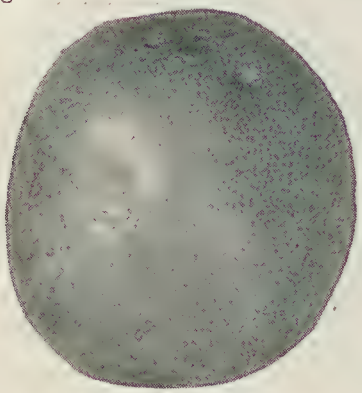
Planting in Irrigation Areas.

In irrigation districts planting behind the plow is best. If dry, it is advisable to irrigate first, then cultivate and harrow as soon as possible, then harrow immediately after planting to conserve moisture. Plow, plant, and harrow each half day's planting before leaving. Never leave planted furrows open at lunch hour or overnight. This is possible with single or single and double plows working in conjunction. Do not leave the furrow to be planted open, but plough a seed-covering furrow and leave the planting furrow to be opened fresh after lunch or at the morning renewal of planting operations.

Descriptions of Varieties.

In the following descriptions of varieties of potatoes grown in Victoria, the terms "first early," "early," "mid-season," and "late" are used to indicate variations in periods of maturation. A "late" variety may be planted at as early a date as an "early" sort, or an "early" sort may be planted as late in the season as late maturing varieties generally are, but the times of maturation are not varied in either case by planting out of season (except, of course, by being shortened or lengthened by favorable or unfavorable seasonal conditions). This explanation of these terms is considered necessary in view of their common misapplication.

Arran Victory.—A blue skinned variety, round shape, white flowers; mid-season maturing.

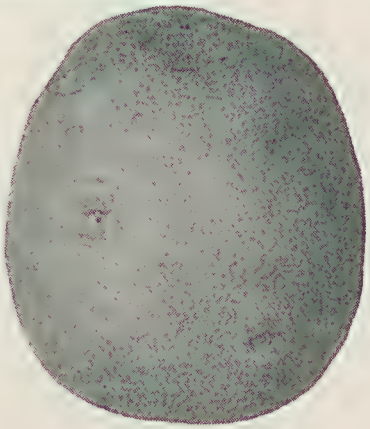


Adirondak.

Arran Banner.—A mid-season, round shaped variety, white skin and flowers.

Arran Crest.—A round, white, early variety, white flowers; rarely blooms.

Adirondak.—A red-skinned variety with pale purple flowers; round shape, mid-season; fair cropper and quality.



Early Carman.

Arran Chief.—White skin, white flowers, tubers round shape with shallow eyes; late maturing, suitable for main crop; heavy cropper and good table quality.

Ash-leaf Kidney.—A first early, good cropper, kidney shape, white skin; flowers white centre, edged with blue; oldest variety still in cultivation.

American Rose.—Not distinct from Adirondak.

Beauty of Hebron.—An early variety, good cropper and quality, skin white with pink blotches, kidney shape, white flowers.

Bismarck.—An early variety, white skin with purple eyes, long oval shape, purple flowers; a good cropper and quality.

Black Prince.—Deep purple blossom and tubers, kidney shape, late maturing.

Brownell's Beauty.—A late variety, fair cropper; suitable for export; round shape, brownish red skin; flowers, dark purple.

British Queen.—A second early variety, white skin and flowers; kidney shape tubers with blunted ends, good cropper, good quality.

Brown's River.—An old standard variety of which there are now few good samples available; flat-oval shape, purple flower, purple skin; late maturing.

Catriona.—A mid-season, kidney shape, purple flowered, yellow splashed with blue skin and yellow fleshed variety; good cropper.

Carman, Early (No. 1).—One of the most popular varieties grown; white skin and white blossom; flat oval shape, good quality; a standard early variety.

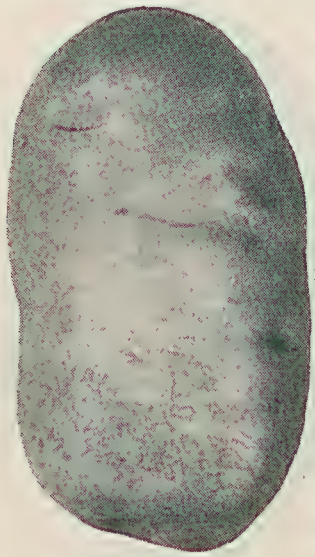
Coronation.

Carman, Late (No. 3).—A good cropping mid-season ripener, white skin and blossom, long oval shape; a sport by bud variation of Early Carman.

Clark's Main Crop or Langworthy.—A fine quality, late variety, flat oval shape, white skin, good cropper; purple flowers.

Cook's Favourite.—Same as Late Carman.

Coronation. — A fair cropping variety, purple blotched with white; round to flat oval tubers, late maturing; flowers white; good carrier; a sport by bud variation of Breere's Prolific.



Late Carman.

Delaware.—Kidney type, first early, white skin and flowers, good quality and croppers; same as "State of Maine."

Earliest of All.—Kidney type, white skin, white flowers, very scarce; heavy cropper and fine quality; a remarkably fast tubering variety; on account of its exceptional all-round merit, this variety is fast coming into favour amongst growers. Table-sized tubers of this variety have been dug 40 days from the date of planting.

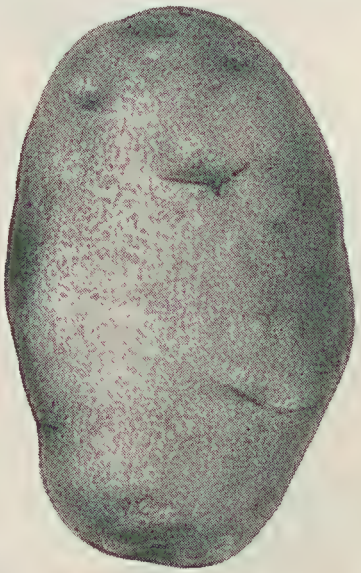
Early Rose.—A first early of good quality; pale pink tubers; kidney shape; white flowers.

Epicure. — A first early variety, white flowers, white skin with often a purple blush at crown, and always some pigment at heel of young tubers; a good cropper, round tubers, deep eyes.

Excelsior.—A late variety, pink skin, deep colour in eyes, round shape, dark purple flowers; a good export variety; late maturing.

Early Norther.—An early variety with oval-shaped, pink-skinned tubers, and white flowers, probably selected from Vermonts.

Factors.—Flat oval tubers, white skin, purple flowers; late maturing; resembling Up to Dates.



Earliest of All.

Field Marshal.—An Up to Date type, with russetted skin; purple flower, and yellow flesh; late maturing.

Gold Coin.—An early variety of the Carman class, with yellowish white skin and white blossoms and oval tubers.

Kerr's Pink.—A round shape, mid-season variety with pink skin and white flowers.

Green Mountain.—An early variety of the Carman class; white skinned tubers, flat round shape and white flowers.

Great Scot.—A round white mid-season variety; white flowers; fair cropper.

King Edward.—A pink and white blotched variety; kidney shaped tubers; good cropper, good quality; purple flowers; mid-season maturing.

King George.—A white skinned second early variety, white flowers, blunt, cylindrical shaped tubers.

Late Manistee.—A sport by bud variation from Early Manistee; pink skinned, flat oval tubers, good cropper, good quality, white flowers, mid-season ripener.

Late Hebron or Orr's Wonder.—A sport by bud variation from Beauty of Hebron; blotched pink and white skin, white flowers, long oval tubers; good cropper and good quality.

May Queen.—A first early variety suitable for market gardeners; white skinned tubers, kidney shape and pale purple flowers.

Manistee.—An early variety with pale pink tubers and white flowers; flat round tubers, good quality, fair cropper.

Manhattan.—Mid-season; tubers blotched purple and white, flat round, good cropper, fair quality; suitable for export, flowers pale purple.

Minato (or Black Manhattan).—A late variety; purple skin and flowers; heavy cropper, flesh white streaked with purple; good quality, a good export variety.

New Zealand Pink Eye.—An early variety round shaped tubers with deep eyes, skin white with pink eyes, purple flowers.

Prolific (or Breere's Prolific).—An oval shape variety, white skin, eyes of tubers tinged with pink, late maturing; flowers white.

President.—A late round oval variety, white skin, reddish heliotrope flowers, pale yellow flesh, good cropper.

Peach Bloom.—A late variety, red skin, flat oval shape, dark purple flowers.

Plunkett.—A blue skinned, rough round, late maturing variety; purple flowers, good cropper, fair quality; a good export variety.

Royal Jersey Kidney.—A second early variety, very prolific, white skin; white flowers rarely open, but drop in bud stage; good cropper—up to 40 tubers per plant.

Red Smooth. — A coarse yellow-fleshed variety, flat oval red skin; late maturing, good carrier.

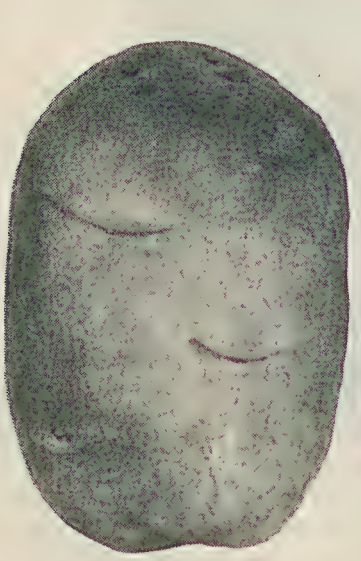
Ruby Red.—A rough round red-skinned variety, deep eyes, late maturing, good cropper; purple flowers; a good export variety, fair quality.

State of Maine.—A first early kidney type, white skinned variety, white flowers; a good cropper and good quality.

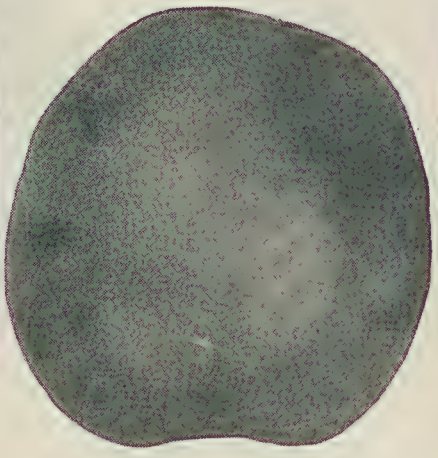
Sussex Red.—A late, rough round, red-skinned variety with deep eyes, purple flowers; a good cropper and a good export variety, poor quality. (Victorian bred, a cross between Ruby Red and New Zealand Pink Eye.)

Sharp's Express. — An early maturing variety; kidney shape, white skin and white flowers.

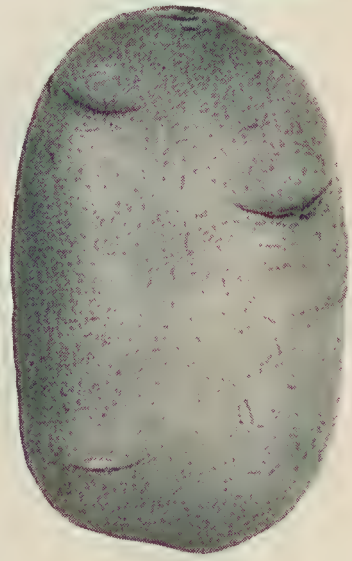
[*Continued on page* 82.



Prolific.



Scottish Triumph.



Up to Date.

Beekeeping for Beginners

By J. W. Thomlinson, Apiary Inspector

THE production of honey in commercial quantities is essentially a rural occupation, and, to ensure a reasonable measure of success, the apiary must be located within an extensive area of nectar-secreting and pollen-bearing bloom. The need for nectar is obvious—without it, honey production is impossible. Just as important is a plentiful supply of pollen, which is required for the continuous rearing of the young bees, necessary to keep the colony at normal strength.

It must not be taken for granted that all flowers secrete or yield sufficient nectar to enable the bees to secure a surplus above that required for the existence of the colony. There are many plants that, while profuse in bloom, are of little or no value from a beekeeping point of view. It is only by experience, or by knowledge gained from those who have had the necessary experience, that the apiarist is enabled to distinguish between bloom which may reasonably be expected to yield a profitable return and that which is practically worthless.

So far as Victoria is concerned true garden honey is not available in commercial quantities, though honey so described has led many an enthusiast in the suburban area to purchase expensive hives and equipment in anticipation of indulging in an interesting and profitable pastime. There may be a wealth of bloom in the numerous flower gardens surrounding the suburban home, and the bees may be seen busily working among the flowers, and continuously bringing in loads of pollen or bee-bread. Despite this, an examination of the combs within the hive will disclose that, in the great majority of cases, there is barely sufficient honey to provide food for the colony during the winter months. There are a few exceptions, however, and as much as 30 lb. of surplus honey has been taken during a season from a strong colony located within the suburban area. But such cases are rare, and, in almost every instance, investigation has shown that the bees have had access to Sugar Gums (*Eucalyptus cladocalyx*) or, when the hives are located in a seaside suburb, to Coast Ti-tree (*Leptospermum loevigatum*). Actually we are indebted to the native eucalypts for at least 95 per cent. of the 3,000,000 to 4,000,000 lb. of honey produced annually in Victoria.

Members of the Colony.

THE QUEEN.

Under normal conditions in the spring a colony of bees will include three sorts, two of which are females and the other, males, or drones. Of the females, numbering possibly from 30,000 to 40,000, in one only, the queen or mother bee, have the sexual organs been fully developed.

After impregnation by a drone, the sole mission of the queen is to lay the enormous number of eggs necessary for the production of young bees, which are continually required to keep the colony in existence. The number of eggs laid by a queen varies from time to time, being regulated by the prospective requirements of the colony, or the space available. She is capable of laying as many as 2,000 to 3,000 eggs within 24 hours, and has the power to produce either sex at will.

In appearance the queen bears no resemblance to the drone; compared with a worker bee her body is considerably longer and more tapered, making it a comparatively simple matter to identify her.

The average life of a queen is about three years, and she reaches the peak of her egg-laying capacity in the second season, after which she deteriorates. From this time on the colony will gradually diminish in numbers until she is replaced by a young queen.

The Dzierzon Theory.

A study of the Dzierzon theory put forward by the Rev. Dr. John Dzierzon, in 1845, will perhaps enable the reader to understand better the power of the queen bee to produce either sex at will. The theory, although repeatedly attacked, has stood the test of time, and in principle still remains unshaken.

1. A colony of bees, in its normal condition, consists of three characteristically different kinds of individuals—the queen, the workers, and (at certain periods) the drones.

2. In the normal condition of a colony, the queen is the only perfect female present in the hive, and lays all the eggs found therein. These eggs are male and female. From the former proceed the drones; from the latter, if laid in narrow cells, proceed the workers, or undeveloped females; and from them also, if laid in wider, acorn-shaped and vertically-suspended, so-called royal cells, lavishly supplied with the peculiar pabulum or jelly, proceed the queens.

3. The queen possesses the ability to lay male or female eggs at pleasure, as the particular cells she is at the time supplying may require.

4. In order to become qualified to lay both male and female eggs, the queen must be fecundated by a drone or male bee.

5. The fecundation of the queen is always effected while on the wing. Consequently, in order to become fully fertile, that is, capable of laying both male and female eggs, the queen must leave her hive at least once.

6. In the act of copulation, the genitals of the drone enter the vulva of the queen and are there retained, and the drone simultaneously perishes.

7. The fecundation of the queen, once accomplished, is efficacious during her life, or so long as she remains healthy and vigorous; and when once become fertile, she never leaves her hive, except when accompanying a swarm.

8. The ovaries of the queen are not impregnated in copulation; but a small vesicle or sac, which is situated near the termination of the oviduct, and communicating therewith, becomes charged with the semen of the drone.

9. All eggs germinated in the ovary of the queen develop as males unless impregnated by the male sperm while passing the mouth of the seminal sac or spermatheca when descending the oviduct. If they be thus impregnated in their downward passage (which impregnation the queen can effect or omit at her pleasure) they develop as females.

10. If a queen remain unfecundated she ordinarily does not lay eggs. Still, exceptional cases do sometimes occur, and the eggs then laid produce drones only.

11. If, because of age, the contents of the spermatheca of a fecundated queen become exhausted; or, if from enervation or accident, she lose the power of using the muscles connected with that organ, so as to be unable to impregnate the passing egg, she will thenceforward lay drone eggs only, if she lay at all.

12. As some unfecundated queens occasionally lay drone eggs, so also in queenless colonies no longer having the requisitive means of securing a queen, common workers are sometimes found that lay eggs, from which drones only proceed. These workers are likewise unfecundated, and the eggs are uniformly laid by some individual bee, regarded and treated more or less by her companions as their queen.

13. So long as a fertile queen is present in the hive, the bees do not tolerate a fertile worker, nor do they tolerate one while cherishing the hope of being able to rear a queen. In rare instances, however, these rules are broken. Fertile workers are sometimes found in the hive immediately after the death or removal of the queen, and even in the presence of a young queen, so long as she has not herself become fertile.

The Workers.

Worker bees, which are familiar to all, form the main body of the colony. They are females, but with the sexual organs undeveloped. Though unable to reproduce their kind, they cheerfully accept full responsibility for the rearing of the family from the moment that the egg destined to produce the young larva is deposited by the queen.

As the name suggests, these bees do all the necessary labour of the colony. In addition to the rearing of the brood and wax production, this includes wax production, comb building, nectar and pollen gathering, water carrying, and ventilation and regulation of the inside temperature of the hive. During the winter, when there is little or no work to be done, the workers may live three or four months, or perhaps a little longer, but, during the busy season the average life is about six weeks.

The Drones.

In appearance, drone or male bees are larger and considerably broader than workers. They are reared during the spring and summer months, and even into late autumn, provided that there is a steady supply of nectar being gathered. Their sole function is the fertilizing of the queen and, though tolerated indefinitely by queenless colonies, under normal conditions are allowed to exist only during times of prosperity. As the honey season draws to a close, and the supply of nectar diminishes, the destruction of the drones is decided on by the workers. Not being equipped with stings they can offer little resistance, and fall easy victims to their fierce opponents. Within a few days the massacre is complete, even to the sealed and unsealed larvae in the drone cells.

Races of Bees.

The following races of bees have been introduced into Victoria and used successfully for the production of honey.

Black Bees.

Black bees, although known as such, are really dark-brown in colour. At one time they were in favour with apiarists who specialized in the production of comb honey, the finished product being snow-white in appearance, due to a small air space being left between the honey in the cell and the wax capping. They could, also, be induced to work in the small section boxes more readily than Italian bees. But their numerous disadvantages caused them to be discarded by progressive bee-keepers.

Some of the disadvantages of Black bees, when compared with Italians, are their smaller average yield of honey per colony, the fact that they are less prolific as breeders, vicious, more tolerant of wax moth, and less resistant to disease.

Numerous colonies of Black bees still exist in Victoria, and as they cross freely with other races, sometimes prove a pest to owners of apiaries stocked with Italian or Carniolian bees, the Black drones frequently mating with the young virgin queens, resulting in the production of hybrids.

Carniolian Bees.

In some respects Carniolian bees are similar in appearance to Black bees, and unless one has had previous experience with them, a casual glance might fail to disclose any marked difference. Close inspection, however, reveals a light-grey down, or fur-like band on the upper surface of each segment of the abdomen. Once this feature has been noticed the grey-banded appearance will proclaim the Carniolian even at a distance of a few feet.

In recent years Carniolian queen bees, the progeny of stock imported from Jugo-Slavia, have been raised and distributed in Victoria. When first distributed there was considerable difference of opinion as to the merits of this race of bees. It was even suggested that their importation be prohibited on account of their reputation for excessive swarming, and the possibility of introducing this undesirable feature through the unrestricted flight of drones.

In spite of the objections raised at the time they have made gradual headway, and some of our most prominent apiarists have declared in their favour.

Italian Bees.

Italian bees may safely be divided into two classes.

1. Those imported from Italy direct; and
2. Those imported from America, the descendants of queens originally brought from Italy.

The progeny of the direct strain of Italian queens is usually much darker in colour than the American strain, and in some instances

might easily be mistaken for hybrids (Italian-Black cross). They have a light-brown band on the upper surface of each of the first three segments of the abdomen, but in some cases the band in the first segment is rather indistinct, and might escape notice unless closely examined. This fact has caused a little confusion at times, as the recognized test of purity, for an Italian bee, is the showing of at least three coloured bands on the abdominal segments.

With the American strain, the progeny has a much brighter appearance, and shows three or more distinct yellow, or light-brown bands on the upper surface of the abdominal segments, the shading becoming brighter in colour as it extends from the thorax towards the tip.

It is a matter of opinion as to which of these two strains is the more suitable for honey production. Possibly locality and climatic conditions may favour one strain more than another.

As the Americans have concentrated for a number of years on scientific selection and breeding, for honey gathering qualities, it is natural that they should have met with some success. Apparently this opinion is rather widely distributed, for in 1915, while on the Island of Lemnos in the Mediterranean, the writer had the fortune to come in contact with some Greek apiarists. Realizing the possibility of securing queens of a superior strain, no time was lost in enlisting the services of an interpreter, and making inquiries through that agency, as to where queen bees could be purchased. The reply was to offer the address of some American queen-raisers, with the information that the best queens came from that country.

Quite apart from the merits of either strain, it is generally conceded in the main honey-producing countries of the world that, for general purposes, the Italian bee is superior to all other races.

Cyprian Bee.

Cyprian bees are somewhat similar to the light-coloured strain of Italian bees, showing three to five coloured bands on the abdominal segments, but these broader and of a deeper shade.

The young bees, when seen on a frame of brood, are rather attractive, the bands showing a rich shade of orange against the dark background of the brood comb. (The same appearance may be noted in young bees of the Cyprian-Italian cross). Owing to their vicious habits Cyprian bees are not now in demand.

Unfortunately, they have crossed with the Italian in some districts, perpetuating their stinging qualities, with the result that where once bright golden-coloured bees could safely be regarded as docile, and quiet enough to be handled without the protection of a veil, depth of colour must now be treated with suspicion.

Comb Building and Brood Rearing.

For a colony of bees located in a new home, whether in the hollow of some tree, naturally selected, or in a hive built by man, wax production is the first essential, the wax being necessary for the building of the comb in which

A corner of a modern apiary.

to store the surplus honey and pollen, and to contain the young bee during the early stages of its existence. Bees-wax is a natural secretion of the worker bee. To produce it in quantity, honey must be consumed, and the temperature of the home raised. The bees cluster over the highest point of the spot selected for comb building, and hang suspended in a dense mass. As the wax is secreted it is exuded in small particles from beneath the scales situated on the under side of the abdomen. It is then collected, made plastic by manipulation, placed in the required position, and worked into shape.

The cells of the comb are hexagonal, or six sided, and scientific investigation has proved that this shape is the most economical that could be devised for the purpose. They are made in two sizes, known as worker and drone cells. There are approximately five worker cells and four drone cells to the inch.

Surplus honey and pollen are deposited in the cells first completed, those in the centre of the cluster being reserved for the queen, who deposits an egg in each, often before the walls are half finished. The egg, when first deposited, is in an upright position, one end being lightly attached to the bottom of the cell. No alteration will be noticed during the first twenty-four hours, but at the end of the second day the egg will be tilted at an angle of 45 degrees, and on the third, when due to hatch, will be found in a horizontal position.

At this stage, the young workers, or nurse bees, deposit a small quantity of pre-digested food, a white cream-like jelly known as chyme or chile, around the egg, at the base of the cell, thus a supply of food is available for the young larvae as they emerge from the shell. Feeding of the larvae is continued for a period of five days, in the case of workers, and six and a half for drones. The cells are then capped with a porous substance, composed mainly of pollen and wax.

A gradual transformation from the larvae to the perfect insect takes place within the cell, and in 22 days from the laying of the egg the young worker bee will make its appearance, followed three days later by the drone. For the first fortnight of their existence domestic duties will occupy the time of the young workers; first assisting in the cleansing of the recently-vacated cells, and later preparing food for and attending the young larvae. Field work will next be undertaken, and continued until the end of their short life, at most a few weeks, possibly a few hours only, for strong winds, cold showers, birds, and preying insects take a constant and heavy toll of the energetic little members of the colony.

(Further articles of this series will appear in subsequent issues.)

Ball Smut in Wheat (*continued from page* 59).

TABLE 1.—YIELD TRIALS WITH PICKLING COMPOUNDS.

Seed Treatment.	Longerenong. Average Yield, 9 years, 1925–33.	Werribee. Average Yield, 6 years, 1925–30.	Rutherglen. Average Yield, 5 years, 1925–29.
	Bushels.	Bushels.	Bushels.
Copper carbonate (2 oz. per bushel)	37·0	11·3	26·8
Formalin (1–450 for 3 mins.)	35·7	10·4	23·8
Bluestone (1¼ per cent. for 3 mins.)	34·1	10·3	22·4

It will be seen that when wheat is wet pickled, the subsequent yield is reduced, bluestone being worse than formalin in this respect. At Rutherglen, where it is important to get the plants through the surface and well established with as little delay as possible, pickling with formalin reduced the yield 3 bushels per acre below that from the dry pickled seed, while over a five-years period bluestone made a difference of as much as 4.4 bushels per acre.

Summary.

1. The three smut diseases of wheat are flag smut, loose smut, and ball smut.
2. Flag and loose smuts are not controlled by ordinary pickling methods.
3. Ball smut is controlled by careful and efficient pickling—
   (*a*) Wet pickling with formalin or bluestone, which retard germination and reduce yield.
   (*b*) Dry pickling with copper powders, which does not retard germination nor reduce yield. It is the most convenient and, taking all factors into consideration, the most efficient method available.

Numurkah Farm Competition

Report of the Judges, Messrs. H. C. Forster, M.Ag.Sc., Cereal Research Officer, Department of Agriculture, and W. G. Pogue, Toolamba.

THE jubilee anniversary of the Numurkah Agricultural and Pastoral Society was marked by a farm competition open to all farmers residing within the district served by the society. Competitions of this type, whether for the whole farm or for one section such as the crop and fallow, have been of much value. Lessons as to the value of the various methods of management have been learned; ideas as to the benefits or otherwise of certain rotations of crops have been gained, and the values of certain doubtful practices have been demonstrated. It is significant that those agricultural societies which show the greatest interest in competitions of this type are those which contain the most up-to-date and progressive members.

The judging of a farm is no easy task, including as it does the various sections of cropping, stock, buildings, home and general management, and much careful thought is necessary in the preliminary work of evaluating the relative importance of the various farming activities. This will vary with the district concerned, and, in addition, due weight must be given to their present financial position. For instance, the average rainfall of the Numurkah district, viz., about 17 inches, allows stock to play a large part in the farm economies, especially in view of the high returns at present being received from sheep and wool. Cropping as a consequence must occupy a position of less importance than it would in the drier districts of the Mallee. Similarly, in considering the water supply, it has to be remembered that the provision of the large dams essential in the Mallee is not so vital in Numurkah where good stock water can be obtained by bores.

Hay carting on a Numurkah farm.

Stud Clydesdales on the property of Mr. J. A. Tweddle.

Primarily the farm is a business proposition, and each section is there to add its quota either directly or indirectly to the total income. Financial considerations therefore are fundamentally important. However, in view of the fact that the conditions of entry referred only to the care, condition, and quality of crops, stock, and buildings, consideration of this factor had to be omitted from the scale of points. The accompanying table shows the distribution of points and the awards in the various sections.

There were six entries in the competition, and the fact that only ten points separated the first and fifth farms indicates the even standard, and reflects great credit not only on the individuals concerned, but also on the district as a whole.

First prize was awarded to the property of Mr. J. A. Tweddle, which scored a total of 151 points. His farm, which has a total area

of 960 acres, was the smallest exhibited. Thoroughness evidently has been the keynote of Mr. Tweddle's operations, and, no doubt due partly to his smaller area, he was able to show evidence of the same care in all sections of his exhibit. The total area under crop during the year totalled 315 acres, 200 of which were sown to wheat and 115 to oats and shandy hay. The fallowed area, which consisted of 275 acres, had been well worked

FARM COMPETITION, NUMURKAH.

DETAILS OF AWARDS.

SECTION.	Possible Points.	J. A. Tweddle.	W. J. Thornton.	W. H. Hodge.	D. J. Hendy.	J. Mortimer	W. Baxter.
1. CROPPING—							
(a) Character and condition of Farm Crop	30	19½	21	24½	17	23	16
(b) Condition of Fallow	10	8½	6	6½	8	6	5
(c) Condition of grass lands	10	5	5	5½	5	6	5
Total	50	33	32	36½	30	35	26
2. STOCK—							
(a) Quality and condition of horses	17	17	14	12	12	9	10
(b) Quality and condition of sheep	17	14	14	13½	12	14	13
(c) Quality and condition of cattle	9	5	5	6	6	4	6
(d) Quality and condition of pigs	4	0	0	0	3	2	0
(e) Quality and condition of poultry	3	2	2	2½	2	1	1½
Total	50	38	35	34	35	30	30½
3. MANAGEMENT—							
(a) Subdivision of Farm, and arrangement of Buildings	15	10	10	8	10	10	7
(b) Water Supply	10	7	8½	7	7	8	6
(c) Fodder Reserves	10	5	3½	5	4½	7	4½
(d) Apparent rotation of cropping	10	7	6	6	5	6	5
(e) Stock shelter and tree planting	5	4	4	3½	4	3	4
(f) Absence of vermin and weeds	5	4	4	2	3	4	3½
Total	55	37	36	31½	33½	38	30
4. FARM EQUIPMENT—							
(a) Condition and care of buildings, barns and sheds	15	14	12	9	12	8	8
(b) Condition and care of machinery and implements	15	10	12	12	12	12½	9
(c) Condition and care of fences and gates	10	8	7½	7½	6½	7	6½
Total	40	32	31½	28½	30½	27½	23½
5. HOME—							
(a) Condition and suitability of house	10	6	9	8	8½	5	5
(b) Condition of Surroundings	5	3	3½	3	4	2	2½
(c) Condition of orchard and vegetables	5	2	2	4½	2	3½	3
Total	20	11	14½	15½	14½	10½	10½
GRAND TOTAL	215	151	149	146	143½	141	120½

1st Prize—J. A. Tweddle

2nd Prize—W. J. Thornton

3rd Prize—W. H. Hodge

and sheeped in spite of the unsatisfactory season, and was the best seen during the whole inspection.

In the stock section, Mr. Tweddle showed out to particular advantage. The twelve geldings that comprised his working team were in excellent condition, and would compare very favorably with the best from other districts of the State. His five mares, two young colts, and two fillies, together with a part ownership in a stallion, completed this section. Mr. Tweddle's sheep included his stud of Border Leicesters, which were in good condition, and of excellent type, and a fine lot of 120 lambs. The condition and arrangement of farm buildings and sheds were characteristically good, particular attention having been paid to the accommodation and shelter of the working horses, stud mares, and young stock.

Second prize was awarded to the property of Mr. W. J. Thornton with only two points less than the winning entry. In contrast to the winning farm, this property was the largest exhibited in the competition. The total area amounted to 1,920 acres, comprised of three 640-acre blocks. Of particular interest was Mr. Thornton's method of management of these blocks. The home block and the adjacent 640-acre block were reserved principally for cropping, and about 510 acres of crop and 410 of fallow were exhibited. The third block, which was distant about 2 miles, was used for grazing purposes only, and had carried 620 ewes and their lambs through the past season. On account of the greater area of this farm, Mr. Thornton was unable to give as much attention to the individual sections as had Mr. Tweddle, and the two farms presented interesting comparisons of extensive farming as compared with more intensive methods. There is no doubt that valuable information on the relative merits of the two methods would have been gained had the competition included consideration of the financial returns obtained.

Stock again represented a most important section of the farm activities. The horses, which were bred and reared on the property, were of a fine type, and reflect great credit on their owner. They included nine geldings, nine mares, four of which were in foal, three yearlings, and one three-year-old colt. A stallion was also maintained with another breeder. The crossbred sheep which were carried on the grazing block were in good condition, but the majority of the lambs which were by Southdown rams, had been sold and trucked prior to the inspection. In the home section, Mr. Thornton scored very well with a nicely designed house and garden. Considerable trouble has been taken to supply all the most modern conveniences.

Third prize was awarded to Mr. W. H. Hodge, who scored well with his cropped areas. At the time of judging the area of 450 acres sown to wheat gave every indication of averaging more than seven bags to the acre. Oats had been sown on 40 acres,

Mr. Thornton's implement shed.

shandy hay on 20 acres, while an area of 400 acres had been fallowed and was in fairly good order. Stock were again fairly well represented, although the horses were not up to the standard of those on the first two farms. The orchard surrounding the house was particularly good, the citrus trees being excellent specimens and well laden with fruit.

Cropping.

The balance between the various farm activities is a very important matter to the farmer who wishes to make the most of his opportunities. In some districts there is little possibility of other than cereal farming, but around Numurkah, farmers are fortunate in the fact that that diversified agriculture is practicable, and that several lines of activity may be engaged upon as opportunity offers. During the years of high wheat prices, cereals were very profitable and received the major portion of the attention of the farmers, but with the low prices offering at the present time, interest has been partly diverted away from wheat. Horse-breeding has been well established for many years, but lapsed when

prices of stock declined. During the last year or two, however, interest has been revived, and very high prices have been obtained for stock bred in the district. Sheep-breeding and wool production likewise have been among the staple industries of the northern district, and at the present juncture, with the low returns for wheat and the rising prices for wool and increasing values for sheep and lambs, there is a distinct swing over from wheat to sheep. It has to be remembered, however, that wheat-growing requires the employment of more labour than does the grazing of sheep, and that, on many average-size blocks, the time of the farmer and his family could not be employed profitably by sheep-grazing alone.

Careless farming methods are never advisable. If after consideration it has been decided that because sheep are more profitable at the moment, it would be desirable to decrease the area sown to wheat, it is not economic to farm that smaller area badly, for instance, by allowing the weeds to grow on the fallows for the benefit of the sheep. Inefficient methods do not help matters, and only further reduce the returns.

The season for the past year was characterized by a dry autumn in which no early rains were sufficiently heavy to germinate the wild oats and other weeds. Consequently when the "break" in the weather came late in May, farmers were reluctant to hold the seeding until an effective "kill" of weeds was obtained, since late sowing during the last few years of wet seasons has been attended with most unsatisfactory results. Germination was excellent, and growth up to the middle of September gave the promise of very high yields. The dry spell which followed during October and November had its effect, especially on late-sown crops and those showing very flaggy growth. However, fairly satisfactory yields should have been obtained, and the crops in the competition were expected to average between six and seven bags per acre.

On account of the seasonal conditions all the crops examined were well sprinkled with wild oats and other weeds, which in view of the dry finish must have had a material affect on yield. The disease of "flag smut" was very prevalent in most of the crops. It is evident that many farmers in this district do not pay sufficient attention to their cultivation and cropping methods. Weed control is largely a matter of concentration on efficient fallowing and grazing. Once a crop of wild oats has been allowed to seed, plants will reappear with every fresh ploughing for many years to come.

The problem of "flag smut," which is common to the whole of the northern district where climatic and soil conditions are favorable to the disease has not been so easy to overcome. Fair success has attended the practice of burning stubbles and the replacement of the usual fallow, wheat, fallow rotation by one in which oats are grown after the wheat. Definite examples of the value of these practices were seen on Mr. Tweddle's property where the flag smut infection was noticeably reduced in certain of the paddocks. However, during recent years, experiments have shown that certain varieties of wheat are notably resistant to this disease, and a much easier and more efficient method of control is therefore available to farmers. Two such varieties which combine with this disease resistance satisfactory yielding qualities are Ghurka and Nabawa. The former is a mid-late season wheat, rather short strawed, not suitable to very dirty ground, while the latter is early to mid-season in maturity, and although longer in straw has a decided tendency to lodge with high winds. A very nice crop of Ghurka, which was seen on Mr. Hodge's property, gave every indication of yielding as high as nine or ten bags per acre, the highest yield of any crop exhibited, and, in addition, showed practically no flag smut as compared with a heavy infection on an adjacent crop of Free Gallipoli.

The area sown to oats in the Numurkah district is not very large, farmers generally sowing only sufficient for their own hay or grain requirements. In view of the possibilities of profit in sheep, it is worth while considering the advisability of increasing the area of stubble-sown oats during the coming year. By devoting the increased area to grazing for sheep, the feed on the natural pastures can be augmented during the lean periods and larger numbers of stock carried. The oat crops generally were not up to the usual standard of the district, the late "break" having prevented an early start. The quality (as hay) in the majority of cases should be excellent as heads were well formed. One or two crops of Mulga, an earlier oat than Algerian, were showing up well, and should give the higher yields. In wet seasons,

however, this oat, unless sown late or eaten off heavily, is liable to grow very coarse in the straw.

On the whole, the fallows exhibited were poor. The season has not been favorable, since most districts have not received very many heavy falls of rain. Consequently, a number of the exhibits had been only ploughed and harrowed at the time of the inspection. Sheep had not been used as often as was necessary, and weeds were fairly plentiful. If benefits are to be obtained from fallowing, it is desirable that the fallows be given at least one working before harvest, and it is essential that the weeds be kept from growing. Experiments have shown that the prevention of weed growth is the most important function of fallowing, since both moisture and plant food must be lost during their growth. Half measures, under which farmers allow weeds to grow on the fallow for the sake of the sheep, are useless from the cropping point of view.

The grass lands shown were all natural pastures, and contained chiefly barley grass and a little trefoil and cluster clover. Mr. Mortimer has shown initiative in attempting to establish subterranean clover on one small paddock. He states that even during the present poor sub-clover season, substantial increases in carrying capacity could be noticed in this paddock. The commercial subterranean clover seed at present on the market is chiefly of a late type and is not so well suited to the northern district as it might be. With the development and propagation of earlier strains by the Pasture Branch of the Department of Agriculture, it should be possible greatly to extend the area under this clover. It is interesting to note that a very good early strain has been obtained from natural plants growing at Mulwala in the Yarrawonga district.

Stock.

The Numurkah district has long been noted for the excellent growth of its stock and for the high quality of the stud farms situated there. Examination of the stock possessed by the competitors amply demonstrated these facts. With the exception of one, all the entrants possessed upwards of twenty horses each, and each farmer was engaged in breeding. Very satisfactory prices had been obtained during the year for some of the young stock. Mr. Tweddle's horses were outstanding in this section, and it was evident that he had gone to considerable trouble in providing for their growth and well-being. Mr. Thornton's horses were not far behind those of the first prize winner, and had the additional merit of having been bred and reared on the property.

Climatic conditions in the Numurkah district appear to be most favorable for the fattening of sheep and lambs through the wetter months of the year, and in spite of the bad season for grass through the autumn and winter, some excellent lines of ewes and lambs were seen. Unfortunately, some of the earliest and best of the lambs had already been sold and trucked. Preference was shown by the competitors for crossbred ewes, although one line of excellent comebacks was seen. The fact that for some years past the Numurkah district has possessed a number of very high class Border Leicester studs must have had its influence on the question of the breed of rams used. Examination of the flocks exhibited showed that five of the six entrants favoured this breed. The returns from the Border Leicester studs, of which there were two shown, have not been very great during the last few years, and in some cases it has been more profitable to sell the young lambs as fats rather than to hold them. However, this breed has shown itself to be well suited to large areas of the northern districts, and it is hoped that the demand for the rams will come again in the near future. The only other breeds used were Southdowns and Shropshires, and the lambs showed the characteristic differences. Unfortunately, the best of these had already been sold, and comparisons between the respective matings could not be made.

With regard to other stock, none of the exhibits was very strong. Mr. Hendy showed a nice lot of fifteen milking cows, while Mr. Hodge and Mr. Baxter had the best entry for fat cattle. Exhibits of pigs were shown by Messrs. Mortimer and Hendy.

Management.

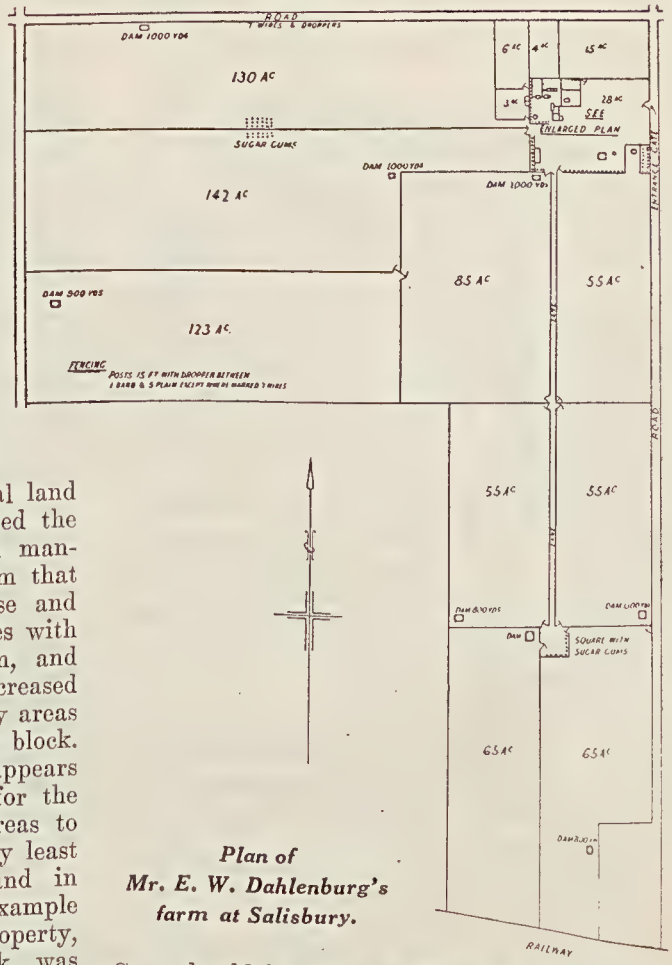
The history of the development of the Numurkah district is full of interest to the student of economics. The development of the farms of the district through three generations of owners is of definite value in indicating the optimum size. Apparently 50 years ago the original selections were of only 320 acres each, and in most cases were heavily timbered. With the gradual clearing of the

holdings and development of bigger machinery it was found that this area was much too small. In the absence of any guiding authority, it was left to economic laws gradually to reduce the number of holdings, and judging by the solidity of the district as a whole at the present time, a more or less satisfactory basis has been reached. It is worthy of note that the average area of the farms in the district is in the region of two to three times that of the original selections. The actual average area for the six farms in the competition was about 1,300 acres, but this included one unusually large farm.

The necessity for acquiring additional land from time to time has greatly increased the difficulties of effective subdivision and management of the properties. It is seldom that the most desirable situation for the house and buildings on the original block coincides with the best situation on the larger farm, and these difficulties are still further increased when it has been found necessary to buy areas distant a mile or so from the home block. The best course of action in these cases appears to be to reserve the nearer paddocks for the cropping and to devote the distant areas to pasture and sheep grazing. In this way least time is lost in travelling the teams and in carting the produce. An excellent example of this was seen on Mr. Thornton's property, where the whole of one distant block was under pasture. With regard to the cropping paddocks, more care should be exercised in making them accessible to the central buildings and yards, either directly or through a central lane leading to the yards. The plan of Mr. E. W. Dahlenburg's property at Salisbury, near Nhill, has been reproduced to demonstrate this point. Where possible, it is advisable also to have the paddocks of approximately uniform size in order to allow of normal crop rotations.

Residents in the Numurkah district are fortunate with regard to their water supply. Most farmers there are able to obtain unlimited stock supplies by sinking bores to a moderate depth. Two of the farms possessed permanent creek frontages, and full use of these was made for summer grazing.

Fodder reserves, on the whole, were insufficient, partly on account of the greater demand for hand feeding during the autumn.



Plan of Mr. E. W. Dahlenburg's farm at Salisbury.

Care should be taken to restore these reserves to a sufficient amount at the earliest opportunity. More attention could be paid to the storing of oats as a reserve, especially if greater numbers of sheep are to be carried. Several oat bins were seen, but in all cases except one, they were empty.

Farm Equipment.

Generally speaking, farm equipment shown by the exhibitors was up to standard. The buildings and barns in particular were well built, and were in good repair. One feature noticed in the implement sheds of both the first and second prize farms was the fact that doors were attached to all the openings. These protected the machinery from wandering stock and birds, and enabled the owners to keep the implements in good condition. The only tractor seen was on the property of Mr. J. Mortimer, who has found it useful in supplementing his horse team during rush periods.

In all cases implements shown were sufficient for the amount of crop sown and were in fair order.

Home, Garden, etc.

Frequently one finds comparatively well-to-do farmers neglecting the important feature of their home life. Untidy yards in which the fowls and any wandering stock congregate, and houses badly in need of a coat of paint are all too common. This criticism, however, cannot be levelled at farmers in the Numurkah district. The majority of the competitors, indeed, appear to be tending towards the other extreme, since every conceivable modern convenience was represented from hot and cold water services to automatic washing machines, electric light plants, &c.

Among the desirable features of a country house, large wide verandahs are perhaps the most important. Spacious well-aired rooms, particularly necessary in the kitchen, make conditions much more pleasant in the hot days of the summer. The home of Mr. Hendy was particularly good in this respect. The eastern verandah had been wired in and separate sleeping rooms made for all the family. In addition a small breakfast room had been enclosed, and here meals are served in the summer. Mr. Thornton also had developed this idea, and both exhibits gave a very good impression.

Some of the competitors had installed sewerage systems at a comparatively small cost, and all appeared to be working splendidly. The disposal of drainage water is often a problem around the homestead, and even the best surface ground systems often are hygienically unsound. In two cases were seen examples of cheap effective underground systems in which a covered pipe from the kitchen was run to a large hole which had been dug in the ground, filled with old tins, stones, &c., covered with an earthen top. No sign of moisture could be seen, nor were any unsavoury odours noticed, and farmers in this district would be well advised therefore to give this system a trial.

In improving the surroundings of his home, Mr. Hendy showed further enterprise in that the entrance drive and yards surrounding the house were all gravelled. Paths inside the garden fence were concreted, and a very neat appearance resulted. For orchard and vegetables, Mr. Hodge scored top marks with a number of healthy, well-kept trees. Citrus trees appear to be admirably suited to the lighter soils of the district, and provided that water supplies are sufficient for summer irrigation, heavy yields of fruit can be obtained.

Potato Growing in Victoria

(*Continued from page* 70.)

Sutton's Abundance.—A fine mid-season or maincrop potato; flat round in shape, white skin and flowers.

Scottish Triumph.—A flat round variety of the Up to Date type tubers, white, purple flowers; late maturing.

Snowflake.—A late variety with long rough-shaped tubers, white skin and pale purple flowers; heavy cropper.

Up to Date.—A late variety, with flat oval, white skinned tubers and purple flowers; one of the best general purpose potatoes in cultivation.

Vermont.—A mid-season variety, kidney shape, pink skin and white flowers.

Warrior.—A late variety, Up to Date type, long oval tubers, purple flowers; a good cropper.

Wellington.—A late variety, blue skin and purple flowers, oval shape tubers; good quality and good cropper; a cross between Brown's River and New Zealand Pink Eye. (Victorian bred.)

White Rose.—An early variety, round shaped, white skin, white flesh and white flowers and good quality; not distinct from Early Carman.

The Care of Cream

Precautions Necessary on the Farm

By J. G. Carroll, Dairy Supervisor

AUSTRALIA is dependent on overseas markets as an outlet for its surplus dairy products, and unless the greatest care is exercised in the production of cream as well as in its manufacture into butter, we cannot hope to compete favorably with countries more conveniently situated to the British market.

Carelessness on the farm and possibly inexperience are the main reasons for much of the lower quality butter manufactured. The decline in the prices of primary products in recent years has caused many land-owners to turn their attention to dairying, the convenience of monthly payments and successive favorable seasons having contributed to this change over. A consequence has been a marked increase in the supply of cream to Victorian butter factories, but, unfortunately, much of this cream has not been of good quality.

Notwithstanding all that has been written and spoken on the subject of the production of a choice grade cream, negligence still exists on many farms, although the dairy-farmer invariably attributes the cause for his cream being classed as inferior quality to the whim of the factory grader and not to the bad conditions under which it is produced. In conscientiously performing his duty the much maligned factory grader is reluctantly compelled to "grade down" any cream not suitable for manufacture into a choice quality butter. The supplier in consequence receives payment on a basis much below the price paid for choice quality cream. A cream grading chart has been prepared, and supplied free of cost to most dairy-farmers, but frequently these charts are used solely as a place of noting calving dates. The object of the chart is to enlighten the dairy-farmer on the causes of and the remedies for faults in cream, and it should be referred to whenever the need arises.

Britain is a buyer of all the choicest butter that can be manufactured and exported. Inferior grades are difficult to sell, and the factory-owner does not want cream of inferior quality. Some producers consider that in some magical way the pasteuriser can convert bad cream into good. Conditions governing the manufacture and sale of dairy produce have altered considerably during recent years. The use of boric acid as a means of preserving the quality is prohibited in butter intended for either local or overseas trade. Factories have instituted a system of stricter grading, and the Department of Agriculture insists upon improved manufacturing conditions, sometimes entailing large expenditure on new plant and machinery. The prohibition of boric acid calls for altered conditions, and the dairy-farmer must adapt himself to the changes necessary by modernizing his premises and methods of production.

Cow sheds and all dairy premises should be built of weather-proof material, and so constructed that they can be easily cleaned. The old straw-covered shed of 50 or 60 years ago has long outlived its usefulness as a milking shed. The roof of such a shed affords little protection from the weather, and is often a nesting place for birds and a harbour for dust.

Milk as it is drawn from the udder of a healthy cow is free from germs, and is of choicest quality. As soon as it comes into contact with hands and the atmosphere it becomes invaded with germ life. Reasonable care taken in the milking operation will lessen the effect of these germs. Two methods of milking by hand are practised—dry and wet. The former is the better, and is recommended, but the latter, unfortunately, is the one frequently adopted.

After a cow has calved the udder should be clipped, and all hair removed therefrom. Prior to the commencement of milking the flanks must be brushed to remove all traces of manure, dirt, or loose hair, adhering to the sides. Cleanse the udder with fresh, clean

water, and dry it before sitting down to milk the cow. Where water is not laid on to the milking shed by pipe line a make-shift may be had by fitting a tap to a small oil drum. The drum can be filled regularly with clean water, thus ensuring a supply in which to wash the hands after each cow is milked. Swilling the hands under a tap is much more preferable to washing them in a dish of water; the water in the dish becomes polluted after the first rinsing, and subsequent ablutions are made in a dish of dirty, germ-laden water, obviously defeating the purpose for which it was provided. Thorough cleansing of the udders of cows and the hands of the milker cannot be too strongly urged in the combined interests of producer, manufacturer, and consumer.

Regulations under the Milk and Dairy Supervision Act make obligatory the cleansing of a cow's udder prior to milking. It is also provided that no poisonous or odorous disinfectants shall be used on the teats of cows in milk or on any dairy utensil. Smoking at any time in the milking shed or dairy premises is forbidden. It might be mentioned that it is an offence, under the Health Act, to smoke in any premises where food or produce for human consumption is being prepared.

All milk should be strained before being placed in the separator vat. Straining is necessary to remove any particles of dirt, &c., that may have fallen into the bucket during milking. Cream will not readily separate if the milk has become too cold. The most suitable and profitable temperature at which to separate milk is in the region of 98° F.; it should never be lower than 85° F. Choicest cream will result if sufficient care has been given in the milking operation. Cream as it leaves the spout of the machine should pass over a water cooler, and be cooled down to a temperature of 60° F., or lower if cooler water is available. Milk and cream are ideal agencies for the growth of germs, and these organisms operate more quickly in warm milk or cream than in cold.

A frequent cause of deterioration in cream is the running of hot water through the separator after the vat has been drained of milk. The bowl acts as a filter, and when hot water is used the slime adhering to the sides is carried into the cream can. Skim milk only should be used to flush the separator, and should not be used in excessive quantity.

Remove the cream from the precincts of the separator room immediately it is cooled, and store in a cool, clean, well-ventilated dairy. Even where the utmost caution is exercised there are always in the atmosphere odours peculiar to a cow shed, and cream is most susceptible to taints and impurities. The dairy or storage room should be far removed from other buildings, and be constructed in such a manner as to allow a good circulation of air. Vents in the bottom as well as in the top of the walls are indispensable. The lid of the cream can should never be placed on the can until it is about to be removed. A perforated covering may be placed over the can to keep out flies, &c. Creams of equal temperature only should be mixed together, and they should be stirred with a metal stirrer. The old wooden stick must be discarded as a means of mixing the cream. The metal stirrer, which has a perforated disc at the bottom is cheap, and can easily be kept clean. It is bad policy to hold cream too long on the farm, and every effort should be made to deliver frequently to the nearest factory.

A penalty of ¼d. per lb. butter-fat contents is inflicted on producers supplying cream of a lower test than 35 per cent. This penalty is prescribed in an endeavour to make the supplier realize the advantages of producing a high-testing cream. Butter-fat does not sour nor lose its quality quickly; it is the milk contained in it which soon sours and spoils the grade. The greater the percentage of butter-fat the longer the cream will retain its quality. The cream-screw set to skim about 40 per cent. should give satisfactory results.

Where cream has to be left at the roadside to be picked up by the carrier the can should not be left unprotected from the weather, dogs, or other stray animals. An effective roadside storage can be erected cheaply after the fashion of a "Coolgardie" safe. The roof should overlap the sides. Carriers do not always run to schedule time, and the farmer who makes provision for roadside storage has an assurance that his cream is not deteriorating in quality if the waggon is running late.

Regardless of the risk of contamination of milk and cream attendant upon the use of kerosene and petrol tins as containers, there are still to be found some who utilize them for this purpose. The first objection is the inferior quality tin of which they are made, and a metallic flavour in the cream is one of the results of their use. The main objection is

the extreme difficulty of thoroughly cleansing them. The seams and crevices in the bottom of the tins soon become clogged with dirt and cannot be kept properly clean. Buckets should be entirely seamless. After washing they should be hung up to allow the circulation of air inside. In proper milking buckets there is a hole in the bottom rim for this purpose.

The importance of thoroughly cleansing dairy utensils cannot be over-estimated. The separator and all parts which come in contact with milk and cream must be properly cleansed after each use. First rinse the buckets, &c., in cold or luke-warm water. (If hot water is used first, the tinning on the utensils will become discoloured through the albumen in the milk adhering to the sides.) The utensils should then be immersed in hot water to which a little washing soda has been added, and scrubbed inside and out with a brush. After all utensils have been cleansed in this manner they should be scalded with boiling water or steam, and allowed to drain. Night and morning the separator and all parts must be thoroughly cleansed. Many dairy farmers neglect to clean the separator at night, and fail to realize that neglect to do so is one of the causes of loss of quality in cream. The accumulated slime inside the separator bowl causes deterioration and also prevents the proper functioning of the bowl, and thus affects the cream test. Wash the separator and all parts after *each* use.

Milking machines are undoubtedly great savers of labour and time, but it should never be forgotten that some of the time saved must be given to cleaning the pipes, &c. An agent anxious to effect a sale may sometimes say that a milking machine requires very little attention and is easily cleaned, but practical experience teaches otherwise. Many preparations for the cleaning of milking machines are on the market, but all that is necessary for this purpose is sufficient soda solution followed up by subjection to an abundance of boiling water or high-pressure steam.

After "washing up" the next work of importance is the cleaning of the cow shed. Droppings must be gathered from the floors of bails and the yard, and removed to a site some distance from the premises. Floors should be swept and the premises made clean and tidy. Stools and leg ropes are worthy of more attention than they usually get; they should be cleaned regularly

To render the premises sanitary and to keep down the fly pest, limewash all walls at least twice a year. Casein in skim milk quickly sets up a chemical action in the milk and it soon sours. For this reason the separator room must not be used as a storage for skim milk. The room is for a specific purpose, and should not be regarded as a storage for lumber of any description.

The keeping of poultry on the dairy farm is to a certain extent a necessary side line, but the birds should not have access to the cow sheds. Fowls allowed the run of the farm are a frequent cause of annoyance, and render the premises dirty. If fowls are kept in their proper place they will give better returns than if allowed to scratch around the cow yard.

The careful and progressive dairy-farmer will pay particular attention to the matter of providing a means for boiling water in close proximity to the separator room. For convenience and utility a copper or steam boiler should be provided. Without a copper and a good clean water supply it is hopeless to expect clean utensils. The practice in vogue on many farms of boiling a tin of water on the kitchen stove is not considered satisfactory. It should hardly be necessary to point out that hot water obtained from the tank of an engine is totally unsuitable for cleansing dairy utensils. Water from the wash-up trough must not be used to swill out the floors of the dairy, as it will set up a foul smell in the building.

The price of butter-fat is extremely low; neglect and carelessness on the farm will make it still lower. It is the duty of dairymen to exercise more care and to endeavour to produce a cream of better quality. Producers can eliminate that unnecessary loss sustained through the production of "faulty" cream. With energy (one of the qualifications necessary for success in dairying) and cleanliness there can be but one result: Better cream, better butter, and better prices.

Summer Treatment of Orchard Insects

By Keighley M. Ward, B.Agr.Sc., Assistant Entomologist.

IN all orchard work the object is to produce a good crop of fruit—good in quantity, quality, and appearance. The appearance of the fruit will depend largely upon its being free from blemishes caused by insects, and, in spite of all the winter spraying against one group of pests and the spring spraying against another group, there are still many insects which attack the fruit as it is coming to maturity during the summer. These insects may cause a reduction in the quantity of fruit produced, or they may blemish or distort it and so render it unsaleable. It is necessary, therefore, to combat certain insect pests right up to the time the fruit is picked from the tree.

The following are the more important insect pests against which fruit-growers need to guard during the summer, and the measures that should be taken for their control.

Codling Moth (*Cydia pomonella* L.)

The Codling Moth is the principal pest of apples and pears. The moth commences its activity in October, when the first brood begins to emerge, and is active until March. The moth lays eggs on the leaves and fruit, and in a few days the larvae hatch and eat their way into the fruit.

In the past the method of controlling this pest has been by means of arsenate of lead sprays, applied every two or three weeks throughout the summer. As a result, the mature fruit was generally covered with a residue of arsenate of lead, and the amount of arsenic per pound of fruit, permitted under the health regulations (viz., 0.01 grain) frequently was exceeded.

This problem of too much arsenic on apples and pears has recently been solved, we believe, by the adoption of a new spraying programme which has been tested by the Department over a period of five years. In this programme there are two calyx sprays of lead arsenate (5 lb. paste in 80 gallons of water) applied in October and early November. Later sprayings consist of white oil (1 in 60) which is directed against the egg stage of the moth, the first application being made in early December and

others early in January and February. The correct time to apply the sprays can be determined by the use of 10 per cent. vinegar lures.

Fig. 1.—The Codling Moth.

The use of this programme not only greatly reduces the amount of arsenic residue on mature fruit, but actually gives a higher degree of control of the pest than any other spray programme known.

Another improvement in the control of Codling Moth is in the use of chemically treated bands placed around the tree trunks to trap the larvae. When the larvae enter the bands to spin cocoons they are killed by the chemicals present, so that it is not necessary to remove the bands to destroy them. Bands should be in position on the trees to catch the larvae as they go to seek their winter quarters.

Light-brown Apple Moth (*Tortrix postvittana* Wlk.)

The Light-brown Apple Moth belongs to the family Tortricidae, and is often referred to as the apple leaf-roller. It is active throughout spring, summer, and autumn, and, while not as great a pest as the Codling Moth, causes considerable damage to various fruits, vegetables, and decorative plants. The moth is indigenous to Australia. Its native food plants are acacias, but in Victoria it has been observed attacking apples, pears, stone fruits, citrus, grapes, gooseberry, strawberry, and such garden plants as asters, rose, chrysanthemums, mignonette, boronia, begonia, lasiandra, potato, cabbage.

Life History and Habits.

The adult moths shelter during the day under leaves, &c., and become active in the evening, when egg-laying takes place. The eggs are deposited in masses of 100 or more on leaves, fruit, and bark. Each egg is flattened, oval in outline, and light-green at first, later becoming yellowish, and finally dark-grey just before hatching. The incubation period is about 14 days.

After emerging from the egg the young larva spins a loose web on the surface of the leaves or fruit on which it feeds. Each larva feeds singly; the species is not gregarious as are other members of the Tortricidae. As each larva grows it extends its webbed shelter, often rolling the edge of a leaf, or joining a number of leaves together, particularly at the apex of a shoot. When attacking an apple or some other fruit it may web together a leaf and fruit, and in this sheltered position will eat out patches of skin and flesh of the latter. Young apples attacked in this way become distorted and badly blemished. The larva usually does not eat right into the core, although this does occur sometimes.

Occasionally this pest is troublesome in orange groves, when the larvae attack young shoots and the rind and pulp of the fruit, causing distortion and premature ripening. In vineyards they damage bunches of grapes. Whatever fruit trees are attacked the larvae feed readily on both the foliage and fruit. They also damage apples in storage, one grub being capable of spoiling half a dozen or more fruits in a case.

The full-grown larva is more than $\frac{1}{2}$-inch long, and greenish-grey in colour, with a darker green line running along its back, and a green line on each side. Long hairs are thinly scattered over the surface of the body. The larval stage varies from five or six weeks to several months.

Fig 2.—Light-brown Apple Moth.
(Top, female; Lower, male.)

The transformation from the larva to the pupa takes place in a flimsy cocoon, which is often spun within a rolled leaf. Unlike the Codling Moth, the larva does not spin a strong

cocoon in the rough bark at the base of the tree. The pupal period occupies from two to four weeks.

The adult moth is about the same size as the Codling Moth, but the wing markings are very different (cf. Figs. 1 and 2). The forewings are yellowish-brown, with darker markings, as shown in Fig. 2. The hind wings are light-grey. The male and female are readily distinguished by the markings, and the latter is darker in colour than the male. Egg-laying commences within two or three days of emergence, each female depositing 100 eggs or more. The length of life of the adult is about ten days.

In Victoria there are about three broods of the moth between early spring and autumn, the number varying slightly in different districts. The moths are most numerous during February and early March, and are often particularly prevalent in late varieties of apples, e.g., Yates, Rome Beauty, and Statesman. It appears that this insect does not hibernate throughout the winter like the Codling Moth, but can be found in the larval stage feeding on the foliage of various plants. During the winter the growth of the larva is very slow, and it does not transform to the pupa until spring.

Control Measures.

Since this moth does not hibernate on deciduous fruit trees winter control measures, such as bandaging, are useless. All steps taken to combat the pest must be made in spring or summer. The most effective insecticides are arsenate of lead (1 lb. in 25 gallons of water) directed against the larvae, and white oils (1 in 60) against the eggs. In the case of such fruits as apple, pear, and grapes, which must not show arsenic residue on the mature fruit, it is advisable to attempt to suppress early broods with arsenate of lead applied with considerable pressure to force the spray into fruit clusters and leaves joined together by webbing. As the fruit grows larger white oils should be used. Sprays must be applied at intervals of about four weeks through the spring and summer. Lea has recorded that in Tasmania the larvae of this moth are parasitized by a fly belonging to the genus *Masicera*.

Red Spider and Bryobia Mite.

These mites attack apples, pears, plums, and other fruit trees, vegetables, and other plants. They feed on the leaves by sucking,

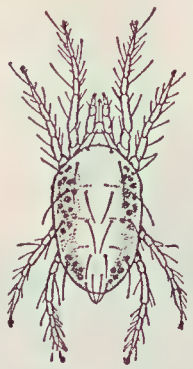


Fig. 3.—The Red Spider.

and cause them to become mottled and russetted. At a later stage the leaves turn brown and fall from the tree. They breed very readily in warm, dry, sunny weather, reproducing by means of eggs which are deposited on leaves and other parts of the tree. The eggs of Red Spider are colourless, while those of Bryobia Mite are reddish. The Red Spider spins a dense but very fine network of silk on the under surface of the leaves on which it lives and breeds. The Bryobia Mite spins no web.

These pests can be controlled in the summer with white oil sprays used at a strength of 1 in 50. Nicotine sulphate will kill the mites, but is ineffective against the eggs. Apple and pear growers who use white oils in the summer for controlling Codling Moth will not be troubled with these mites.

Fig. 4.—Bryobia Mite.

Scale Insects.

During the summer months Scale Insects are at the height of their activity. They are all very minute, but can cause a great amount of harm if not checked. All scale insects live with their sucking mouth-parts inserted into either the bark, the leaves, or the fruit of plants. When very young the scales insert their mouth-parts into the plant, secrete a protective, waxy covering over themselves, and in

this condition they remain for the rest of their lives, sucking the sap from the plant, and reproducing the next generation.

Fruit trees heavily attacked by these insects will not bear fruit, their growth becomes stunted, and eventually they may die. On trees less severely attacked the scales will infest the fruit and disfigure it.

San José Scale (*Aspidiotus perniciosus* Comst.).

The San José Scale is one of the principal scale insects in the State, because of its great destructiveness, the difficulty of eradicating it, and because no fruit bearing any signs of this pest is allowed to be exported or sold on the local market. These precautions are necessary to prevent the spread of the scale.

During the summer this insect reproduces rapidly, each female being able to produce up to 600 young in six weeks. It is at this time that the insects spread from tree to tree.

In spite of the successful campaign against the insect during the past winter it will not yet have been completely eliminated from all apple and pear orchards. Growers therefore are advised to keep a look-out for it, particularly on pears in the Goulburn Valley. The scale is often found in the "eye" of the fruit, and has the appearance of a circular, greyish speck, about the size of a pin's head. If it has been established on the fruit for some time it will be surrounded by a reddish circle or halo.

Wherever it is found the trees should be sprayed very thoroughly with white oil, 1 in 60. It is suggested that growers who intend to export pears in the coming season should not include in their consignments any fruit which has come from trees which have in the past two seasons been infested with San José Scale.

Red Scale of Citrus (*Chrysomphalus aurantii* Mask.).

This scale attacks the leaves, bark, and fruit of lemons, oranges, grapefruit, &c. It has been recorded also on the apple, pear, grape, fig, and other fruits, but does not affect them severely.

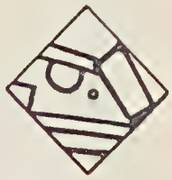
The insect commences to reproduce about the end of November, or early December, and several generations are born during the summer. Control measures must be adopted during the reproducing period, because the young scales are the more easily killed. They can be dealt with either by fumigation or by spraying with white oil at a strength of 1 in 60. Usually spraying is carried out only in February. This is quite a correct time to treat the insect, but it would be a decided advantage to spray also before mid-December. This would destroy the greater part of the first brood of young scales.

The white oil will also destroy the Brown Scale (*Coccus hesperidum* L.) and the Olive Scale (*Saissetia oleae* Bern) which are so common on citrus trees.

Vine Scale (*Lecanium persicae* F.).

The Vine Scale is one of the largest scale insect pests we have, and is becoming important, because of the large number of plants it attacks. While the vine is the principal plant affected, the scale also infests apples, pears, plums, figs, raspberry, mulberry, and a number of garden plants, including rose, virginia creeper, and daphne. It can be controlled by spraying infested plants with white oil at 1 in 60.

Ten years ago, when the pest was attacking grape vines very severely in the Whittlesea district, a parasite was introduced from Western Australia and liberated there. The parasite, a small wasp (*Aphycus timberlaki* Ishü) was so active that within two seasons it had reduced the pest to insignificant numbers. Recently, however, the Vine Scale again became a serious menace in the Whittlesea district. When the matter was investigated it was found that the parasite species liberated ten years ago had survived up to the present time, and was vigorously attacking the scale. It seems that very shortly the parasite again will have checked the pest.



Crop and Fallow Competition

Numurkah's Jubilee Year

Report of the Judge, Mr. H. C. Forster, M.Agr.Sc., Cereal Research Officer

THE Numurkah district has been recognized for many years as being well suited to cereals. Since the early eighties, when settlement there was first commenced, very satisfactory yields have been obtained, and the district average has generally been above that for the State as a whole.

During the past year Numurkah farmers have been celebrating the district's jubilee anniversary, and it is of interest therefore to study the progress that has been made during that period. One sometimes hears the criticism that the average yields of wheat in Victoria have not shown the increase that might be expected as a result of the many years of experimental and extension work. In considering this statement it must be remembered that the areas devoted to wheat growing in Victoria have changed considerably during the past thirty years, since the higher yielding districts have tended to become devoted to more intensive crops, while large acreages of so-called marginal and semi-marginal areas have been pioneered and sown to wheat. A more valid comparison may be obtained by considering the average yield of districts in which the area sown to wheat has not changed to the same extent. In this connexion, yields of the Moira county, which includes the important wheat-growing areas of the eastern portion of the Northern district, are worthy of consideration. As far as can be determined, no large migratory schemes nor great changes in the area sown to wheat there have taken place

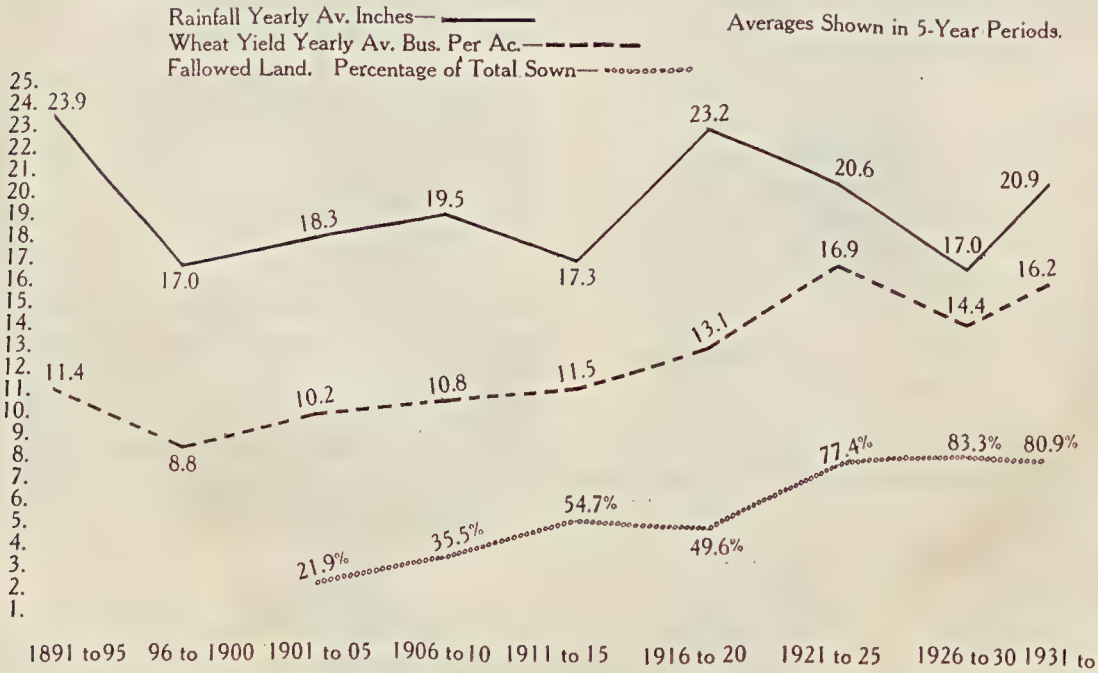


Fig. 1.—Graph showing the relation between average rainfall, average wheat yield and percentage area of fallow in 5-year periods for the County of Moira.

since 1900, and the average yields, together with the rainfall in 5-year periods since 1890, are shown in Table 1, and graphically in Fig. 1.

Table 1.—Average Wheat Yields, Rainfall, and Percentage Fallowed, County of Moira.

Five-Year-Period.	Average Annual Rainfall.	Average Yield.	Percentage Area Fallowed.
	inches.	bus./ac.	%
1890–1894 ..	23·9	11·4	..
1895–1899 ..	17·0	8·8	..
1900–1904 ..	18·3	10·2	22
1905–1909 ..	19·5	10·8	36
1910–1914 ..	17·3	11·5	55
1915–1919 ..	23·2	13·1	50
1920–1924 ..	20·6	16·9	77
1925–1929 ..	17·0	14·4	83
1930–1932 ..	20·9	16·2	81

From these figures it may be seen that, despite a varying rainfall, the average yield of wheat has increased steadily since the period 1895-1899. The higher yields obtained in the years prior to 1890 are due possibly to the higher fertility of the new land used during these years. By the close of the century, continuous cropping had depleted this soil of a large proportion of its natural fertility. With the introduction of better methods, including the use of superphosphate, the introduction of more prolific varieties, and the adoption of fallowing since the early years of the new century, average yields have shown material increases, and at the present time exceed by a considerable margin those obtained during the first years with the virgin soil.

The present crop and fallow competition was held in connexion with the Jubilee Anniversary celebrations, and despite the unfavorable finish to the season, the standard of the crops exhibited has been well above the average. The fallows were judged during March, 1933, and the inspection of the crop section was completed in early December. The combined awards are presented in Table 2.

At the inspection in March, the fallows were in only fair condition. The majority had received only one cultivation, and the seed bed was not well defined. The very dry period which followed up to the second week of May did not afford farmers any opportunity to give the paddocks a further working. Some, remembering the disastrous effect of the wet winters of the last few years on late sown crops, commenced sowing dry, and the majority of the remaining area was "combined in" immediately the heavier falls were received during the third and fourth weeks of May. There was therefore no opportunity for an effective kill of wild oats and other weeds in these crops. Germination was good, and early growth excellent, and the crops at the beginning of September gave every indication of high yields.

Table 2.—Details of Awards, Numurkah Crop and Fallow Competition.

Competitor.	Variety.	Crop, 1933.					Fallow.	Total.
		Yield.	Trueness to Type.	Evenness.	Freedom from Weeds.	Freedom from Disease.	Total.	Total.	Grand Total.
Possible..	.. ..	35	20	15	15	15	100	100	200
H. Formby 1, Wunghnu ..	Free Gall.	30	16	9	13	13	81	89	170
J. Mortimer 1, Katunga ..	Ranee 4H	26	16	13	10	12	77	90	167
A. Young, Invergordon ..	Ghurka ..	19	16	12	13	14	74	90	164
H. Hodge, Invergordon ..	Free Gall.	25	15	12	11	11	74	88	162
R. Adams, Katunga ..	Ranee 4H	27	16	10	11	12	76	85	161
P. Tweddle, Waaia ..	Free Gall.	23	16	11	10	11	71	87	158
H. Formby 2, Wunghnu ..	Ranee 4H	25	15	8	10	12	70	84	154
W. Moss, Kaarimba ..	Ranee .. / Free Gall.	21	16	9	9	11	66	80	146
Hodge Bros., Invergordon	Free Gall.	20	15	8	8	12	63	78	141
S. Hendy, Naring ..	Free Gall.	15	14	10	9	11	59	81	140
A. Miller, Invergordon ..	Free Gall.	17	16	9	8	10	60	80	140
L. Bigger, Waaia.. ..	Free Gall.	22	12	10	10	11	65	74	139
J. Mortimer 2, Katunga ..	.. ..	..	..	..	..	..	..	81	..
R. Jeffrey, Tallygaroopna	.. ..	..	..	..	..	..	..	79	..

The dry spell during October and November had a bad effect on most crops, particularly on flaggy and late sown areas, and in all cases yields were reduced.

At the time of judging, prior to the rains of December, remarkably little effect was noticed on the development of the grain, which though inclined to be small, was not shrivelled in the majority of cases. It was of interest to note the seasonal effect on the quality of the grain. The majority of the crops had ripened rapidly by reason of the dry spell, and the quality was excellent. Free Gallipoli grain, which is usually inclined to be mottled, was showing a fine even texture. In the occasional lower, moister patches, which had matured more slowly, quality was effected, and mottling of the grain was most noticeable. This effect of the method of ripening on the texture of cereal grains has been studied closely in the case of barley, and has been shown to be most important. It is probable that the complaints which have been made as to the poor quality of our wheat during the past season or two may be largely the result of the effect of the slow ripening period during these years, and that a better quality will be obtained with other types of seasons.

A 65-ton stack of Mulga oats on Mr. H. Formby's farm at Wunghnu.

First award in the combined crop and fallow competition went to Mr. Formby's entry of Free Gallipoli, the main portion of which was sown with the combine in the second week of May, immediately following the break in the weather. The outstanding feature of this crop, as compared with most of the others, was its freedom from weeds. Wild oats were practically absent, despite the lack of a cultivation prior to sowing, and the cleanliness of this paddock, which was very dirty with weeds some years ago, may be directly attributed to the thoroughness of Mr. Formby's fallowing methods. His aim, after ploughing early, is to cultivate the ground twice before the summer, using the scarifier for at least one of his workings. By this means, the clods are brought to the surface, and the seed bed laid down in a correct manner. Sheep are used regularly, and not only keep the weeds down, but also aid considerably in the consolidation of the seed bed. The crop was well grown with nicely filled heads, and showed no signs of "burning off," despite the dry October and November. The only disadvantage of this crop from a competition point of view was a certain amount of unevenness occasioned by the crab-holey nature of the country.

Second prize was awarded to the entry of Mr. J. Mortimer, who followed his excellent fallow with a fine even crop of Ranee 4 H. This crop had been grown on a red bank of soil, and was showing a very heavy growth of straw. The dry autumn had not permitted an effective kill of the wild oats and other weeds, and these had accentuated the bad effects of the dry weather.

Third prize in the combined section was awarded to Mr. A. Young's crop of Ghurka. In order to make certain of killing his weeds,

[*Continued on page 96.*

Mr. H. Formby's winning crop of Free Gallipoli.

Insect Pests of the Cherry

By R. T. M. Pescott, M.Agr.Sc., Entomologist.

THE cherry is subject to the ravages of a number of insects in Victoria, the following being the most important:—

(*a*) The Cherry Aphis (*Myzus cerasi,* F.).
(*b*) The Pear and Cherry Slug (*Caliroa limacina,* de Geer).
(*c*) The Cherry Borer Moth (*Maroga unipunctana,* Don).
(*d*) The Cherry Green Beetle (*Diphucephala colaspidoides,* Gyll.).
(*e*) The San José Scale (*Aspidiotus perniciosus* Comst.).
(*f*) The Cherry Looper Moth (*Chloroclystis laticostata,* Walk.).

In addition to the above, the following insects are occasionally met with, but are not considered important except under conditions favouring epidemics:—Thrips (*Thrips imaginis,* Bagn.), Pumpkin Beetle (*Aulacophora hilaris,* Bd.), Apple Root Borer (*Leptops squalidus,* Boh.), Light Brown Apple Moth (*Tortrix postvittana,* Walk.), and the Rutherglen Bug (*Nysius vinitor,* Berg.).

The Cherry Aphis.

(*Myzus cerasi,* F.).

This introduced pest is well known to cherry-growers, because of the habit of the insects congregating on the leaves and buds, and sucking the juices of the plant. While the life history of this insect has not been thoroughly worked out, it is known that it carries over from year to year in the form of eggs which are always to be seen adjacent to the dormant buds.

The main damage to the trees is done in the early and late spring, particularly if weather conditions are cool, when, as the result of the working of the aphides, the leaf growth is so poor and distorted that the developing cherries are unprotected from the weather conditions and also poorly grown.

Control.—Spray with nicotine sulphate or black leaf 40, at the rate of 1 pint of nicotine sulphate or black leaf 40 to 80 gallons of water, to which 2 lb. of soft soap has been added. It may be necessary to apply this spray several times during the season.

The Pear and Cherry Slug.

(*Caliroa limacina de Geer.*)

This introduced insect, the adult of which is a true sawfly, passes the winter in an earthen cocoon 2 or 3 inches below the surface of the soil. In the late spring, shortly after the cherries have come into leaf, the small, black sawflies emerge. They are slightly larger than the common house fly, and possess four wings. The female sawfly inserts her eggs in the leaves, and after a few days these eggs hatch into the soft bodied "slugs" which feed on the leaves for a period of two or three weeks. The damage done is that of skeletonizing the leaves, when just the bare network of the leaf is left. When fully grown, the slugs crawl or drop to the ground, into which they tunnel, finally pupating there. Towards the end of January, the second brood of sawflies appears, giving rise to another generation of slugs, in which stage they cause the greatest amount of damage, especially on young trees, which may be completely defoliated. When this second generation becomes fully grown, the slugs go into the ground, remaining there during the winter.

Control.—The cherry slug is easily poisoned. An application of lead arsenate, at the rate of 1 lb. to 50 gallons of water, applied as soon as the young slugs are noticed on the leaves, will give complete control. Dusting the trees with arsenate of lead (1 lb. mixed with 5 lb. of hydrated lime)) also is effective.

The Cherry Borer Moth.

(*Maroga unipunctana, Don.*)

This native insect, which originally fed on different species of acacias, is now recorded from cherries, plums, peaches, and many varieties of street trees. The adult insect is a white satiny moth measuring up to 1½ inches across the outspread wings. The centre of the fore wing is characterized by a single small black spot, while the abdomen is black,

marked with rich orange down. The moth usually emerges in the evening, and hides under loose bark in the day time. Up to 40 eggs are laid on the bark of the tree. After several days these hatch to creamy larvae or caterpillars which immediately commence to feed on the bark. They surface tunnel around the bark for some time, finally gnawing their way through to the centre of the tree. They cover their activities with a thick meshwork of felted silk web and sawdust excrement, so that they are well protected from any external agencies. In some cases, the surface bark tunnelling becomes so severe that the tree is ringbarked, and whole limbs, or even the whole tree, may die.

Control.—Clear away the sawdust matter at the entrance of the tunnels, squirt into the tunnel a few drops of kerosene or carbon bisulphide, and plug the hole over with clay or grafting wax. In the early stages, the larvae may be destroyed in the tunnels by probing the holes with fine wire.

The Cherry Green Beetle.

(*Diphucephala colaspidoides,* Gyll.)

This native insect, which is a pest of cherries only in the adult stage, is commonly found occurring on the Black Wattle (*Acacia decurrens*) and the native Hazel Scrub (*Pomaderris apetala*). The grub stage of this beetle is one of the cockchafer grubs so commonly found in the soil. The adult beetle, which is metallic green in colour, and measures about ¼ inch in length, is found on the foliage of cherries, particularly in the hill districts, from mid-summer onward, and, under certain conditions, the trees may be defoliated.

Control.—Spray affected trees with arsenate of lead, 1 lb. to 25 gallons of water.

The San José Scale.

(*Aspidiotus perniciosus,* Comst.)

This well-known pest of apples and pears is found frequently on cherries, and, if left unchecked, may cause severe damage, particularly to the young trees. The appearance of this scale is too well known to warrant any lengthy description.

Control.—It is essential that all prunings be destroyed, otherwise there is the possibility of re-infection from this source. The best method of killing San José Scale is by the use of a dormant spray, such as lime sulphur or one of the lubricating oil emulsion sprays.

A Plane Tree deformed by the Cherry Borer Moth.

Lime sulphur at a strength of 1 in 9 is apparently more effective in cooler districts, whereas oils, ranging from 1 in 25 for heavy infections to 1 in 50 for light infections, are more suitable for warmer locations. Winter white oils, in conjunction with lime sulphur, also give very satisfactory results.

The Cherry Looper Moth.

(*Chloroclystis laticostata,* Walk.)

This is another native insect. It spends the winter in a cocoon in the soil, emerges in the early spring, and lays its eggs on the foliage and twigs of the cherry. In a short time, the typical looper caterpillar emerges, and feeds on the half-grown green cherry. The first evidences of the looper usually are noticed in early October. Loopers are of vital importance in cherry-growing, as there is a direct relationship between looper injury and brown rot infection.

Control.—When the first signs of loopers are noticed, spray the trees with arsenate of lead, 1 lb. to 25 gallons of water.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

Pentstemons.

The Orchard.

LATE sprayings for Codling Moth, which is very prevalent this season, should be confined to oil sprays, with or without nicotine, and a spreader should be used. The use of chemical bands is becoming general, and in view of their success, some facts regarding costs are worth mentioning. These figures are supplied from the orchard of Pell and Sons, Upper Diamond Creek:—A roll of cardboard, untreated, cost 3s. 6d.; this and a supply of old packing cardboard, equal to two rolls, were dipped in oil and beta naphthol, costing under £1. These materials provided a total of 600 bands, 3 inches wide, at a cost of a little over £1, or about two-fifths of a penny each. Additional costs were:—Thermometer, 6s. 6d.; and gloves, 2s. 6d.

A trial was made of chemically treated hessian bands; but as these absorbed about eight times the quantity of oil and naphthol their use was abandoned.

The use of lures for the attraction of Codling Moths is also becoming more general. Reference was made last month to one grower having caught 8,000 moths up to the first week in December. At Kyabram, numbers of moths were caught, and, as well, large numbers of Oriental Peach Moths were killed. The usual 10 per cent. vinegar solution was used.

Many losses of apricot crops from Brown Rot occurred as a result of the early January rains. Growers will be wise to cut away diseased clusters and twigs from all trees and burn them, so as to minimize attacks next year.

The Flower Garden.

Growers of flowers will be delighted with the Lilliput Zinnias, which are now in full flower. The plants grow about 18 inches high, and they are massed with flowers up to 1½ inches in diameter. The colours are very bright indeed. It is not yet too late to obtain plants for late flowers, but seed should not be sown. The plants should be manured, and well watered.

Dahlias should be well watered and manured from now on, so that strong plants will result. No cultivation should be done near the plants, as the roots and tubers are now very close to the surface.

Rose bushes should now have all their old flower heads and weak thin shoots cut away. In addition, a dressing of blood manure should be given, and this must be watered in. Spray with nicotine sulphate for aphis, and dust with sulphur if mildew attacks the young growths.

Take cuttings of Antirrhinum and Pentstemon, and plant out in light soil; small side shoots, two to three inches long, having no sign of flower buds, should be selected for planting.

The Vegetable Garden.

Sow seeds of all plants of the Cabbage family in seed beds. Select an open sunny situation; and make up a rather poor sandy soil. The poor light soil makes for an easily lifted plant, and for one not drawn nor overgrown. It is far better to have small, rather starved plants for transplanting than tall leggy ones.

Sow seeds of turnip, carrot, lettuce, and parsnip in rows 9 or 10 inches apart. Make up a good soil and sow the seeds thinly. It will be necessary, when the seedlings have developed well, to thin out the plants; a space of about 3 inches between each plant should be left. Keep the plants, especially the lettuce, very well watered, particularly during hot sunny weather.

Rural Legislation (*continued from page* 56).

The Act also prohibits the use of the so-called box hive throughout the whole of the State. It is provided also that any person who moves a beehive more than 10 chains from the location previously registered shall notify the Department of Agriculture within fourteen days of removal. Bees must not be allowed access to any infected hive, nor must any wax, fittings, appliances, &c., which are infected with disease, or have been used in connexion with any infected hive, be open to access of bees until after sterilization of such material or appliances.

Numurkah Crop and Fallow Competition (*continued from page* 92).

Mr. Young cultivated his ground after the first rains, and delayed his seeding until the first week in June. The crop showed excellent early growth, and was free from weeds. The dry spell in October, however, caught the late variety, Ghurka, in the flag and greatly reduced its yield. When seeding is delayed in this manner, much better results would be obtained by sowing an early variety, such as Ranee, the late varieties being used only for early-sown crops.

In reviewing the general competition, one cannot but be impressed with the manner in which the newer wheats, such as Free Gallipoli and Ranee, have replaced the other varieties. Of the twelve exhibits, seven were sown with Free Gallipoli, three with Ranee, one with portion sown to each of these, and one with Ghurka. During the whole tour of inspection, only two other varieties were seen in neighbouring crops. The excellent standard of the crops generally, and the manner in which they stood up to the bad finish, shows that these varieties must be well suited to the district.

The position with regard to Ghurka is one which calls for some comment. This variety has shown out very well during the last few years at a number of experimental plots in the State, including those at Waaia, and observations on crops of this variety noticed during the inspection, indicate that it will give even higher yields than the two varieties already mentioned. Further, its resistance to the disease, flag smut, should make it a very popular wheat in the Numurkah district. It is necessary to remember, however, that since it is a late variety, it should be sown early, and that owing to its short straw, it is better suited to the clean, well-fallowed areas than to weed-infested paddocks.

With regard to disease in the crops, major importance must be attached to flag smut, which was present to a very large extent through the whole district. The older methods of control, under which the wheaten stubbles were burnt and oats included in the crop rotation, have been neglected to a large degree, with the result that the disease has obtained a very strong hold in the district, and has reduced yields by a considerable amount. When oats can be profitably fed off by sheep and lambs, farmers would be well advised to consider increasing their area of oats on stubble, and thus not only be able to fatten more sheep, but also to obtain better returns from their wheat. During the last few years, experiments have shown that some varieties of wheat are resistant to flag smut, and infection tests were made on the more important wheats grown in the State. It was shown that the two varieties, Nabawa and Ghurka, both of which give fairly good yields, were very little affected by the disease. Thus a third method of control has been made available to farmers. For stubble sown or weed infested areas, the tall variety, Nabawa, may be preferred, leaving the Ghurka for the fallowed areas.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

The Green Peach Aphid (*Myzus persicae* Sulzer) in relation to the Peach in Victoria, and the Measures investigated for its Control.

By Keighley M. Ward, B.Agr.Sc., Assistant Entomologist.

THE investigations, of which the present paper is the outcome, were begun in the winter of 1930, and have extended throughout 1931, 1932, and 1933. All field observations and experiments have been carried out at two centres in Victoria, namely, in the Goulburn Valley and at Burnley. Laboratory work was centred at the Plant Research Laboratory, Burnley.

Myzus persicae Sulz. is the principal insect pest attacking the peach in this State, and for many years has been widespread in the peach-growing districts. Hitherto, very little investigation has been made into the insect's life-cycle and habits, as they occur under the climatic conditions of Victoria, but it has been realized that the aphid deposits winter eggs on peach trees. It has not been demonstrated conclusively that the activities of the insect are controllable by means of egg-killing washes applied during the winter. Experience over many years has shown quite definitely that the control measures generally used against the pest do not achieve the desired result, and that some improved method of control should be sought.

The principal objects of the work have been, (1) to obtain a detailed knowledge of the activities of the aphid in relation to the peach throughout the year, with especial reference to the times at which changes in activity occur, and to the source of infestation of peach trees; (2) to examine the possibility of forecasting severe outbreaks of the insect; (3) to test various egg-killing spray materials against the eggs of *M. persicae* and discover the most efficient of these; and (4) to ascertain whether the insect can be completely controlled in the field by means of an efficient ovicidal spray material. In addition, a contribution is made to the general knowledge of the species in the shape of a detailed description of its principal forms.

ECONOMIC IMPORTANCE.

A general outbreak of *M. persicae* in plague numbers occurs at irregular intervals of three or four years or more. On such an occasion, it is not uncommon for infestation to become prevalent throughout all the peach-growing areas of the State, and there is consequently a severe reduction in peach and nectarine crops. On the one hand a loss is sustained by the canning industry, which exports a great part of the crop from the north of the State, and on the other, there is a loss to the southern growers who supply local markets with fresh fruit. The extent to which crops may suffer is shown in an unpublished report written by Mr. S. Fish, M.Agr.Sc., Assistant Plant Pathologist in the Department of Agriculture, after the very severe outbreak of the aphid in 1928. During this year Mr. Fish was testing the effect of certain spray materials on the Brown Rot disease of peaches. Some blocks of trees had been sprayed in the dormant period with lime-sulphur at 10 per cent. strength (which has since been shown to be highly toxic to aphid eggs), and other blocks of trees had been left unsprayed. The treated trees were quite normal, and showed only traces of infestation by the aphid, whereas those unsprayed were very severely attacked, and were almost completely defoliated. The yield of fruit from these blocks averaged four cases per tree and half a case per tree respectively.

In a plague season losses somewhat on the same scale as that just described are experienced by peach-growers, even after they have

expended much money and energy in attempts to reduce the infestation. The common practice has been to attack the insect after it has become well established on the trees, and has revealed its presence by causing the leaves to become curled and distorted. Once this stage is reached it is almost impossible to reach all of the insects with a contact spray, so that attempts to check their activity generally prove costly and not very effective.

Apart from plagues of this insect, light but fairly general outbreaks may occur in a district in other years, and some orchards may suffer severely. Again, there are many orchards which seem to be subject to attack almost every spring. This is so especially in the southern districts, where the effects of hot north winds in spring are less marked. It is generally believed in the north of the State that the occurrence of these winds in spring is an important factor in preventing the increase of the insect to plague numbers. The occurrence of the aphid in harmful numbers throughout a district, and in isolated orchards, during the period between general outbreaks makes it necessary for many growers to adopt control measures every year.

Source of Infestation

Peach trees may become infested from either of two sources, namely, from the winter eggs, in countries having cold winter climates (e.g., Canada, England, Northern France), and from migrating forms in countries which experience a relatively warm winter (e.g., South Africa). It appears that the most severe injury to the peach occurs where infestation takes place from the winter eggs. There seems to be no reference to the aphid infesting peach trees from both sources, although this might possibly occur in parts of the United States of America, where the aphid overwinters on various cruciferous plants in addition to depositing eggs on peach trees.

In Victoria, infestation in any given spring is considered to take place only from the winter eggs on the trees. This view is strongly supported by the fact that, in spraying experiments, trees which have been treated with an efficient ovicide in the dormant period subsequently have not become infested throughout the following season, whereas unsprayed trees have been heavily attacked. Further support is given to this view by the observed absence of *reproducing* winged forms (which might have migrated from secondary host plants) on the peach in early spring. In the severe epidemic which occurred in 1928 there is, again, no evidence to show that infestation took place from any other source than the winter eggs. On the contrary, the fact that the trees sprayed with lime-sulphur in Mr. Fish's experiments did not become infested with the aphid throughout that season shows fairly conclusively that, even in a plague, no part of the infestation is due to migrating forms.

The question might well be raised as to the fate of those young aphids which emerge from eggs before midwinter. Apart from those which are washed off the trees by rain and killed, it is believed that the majority of them are able to survive. Ample evidence has been obtained in the field to show that aphids are able to feed on dormant fruit trees. Thus *Anuraphis persicae-niger Smith* (the Black Peach Aphid) has been observed to feed and reproduce on peach trees continuously through the winter months, commencing its activities in June. This species is able to feed on both the buds and the woody stems of laterals produced during the previous growing-season. Another species, *Myzus cerasi F.*, is able to feed and develop on dormant cherry trees. In July of 1933 a group of these aphids was observed on a cherry twig, and they had already passed through three or four instars. In this case, as a result of the feeding of the aphids, several of the blossoms were opening, although not due to do so for another two months. With regard to *M. persicae* adult fundatrices have been found on peach laterals at the time the buds are swelling, i.e., end of August. Since these forms take nearly four weeks to develop to maturity it is obvious that in their early instars they must have obtained nourishment from the dormant buds. It has been shown by Davidson[1] that the salivary secretion of a species of *Myzus* exerts a diastatic action on the insoluble carbohydrates (e.g., starches) converting them into soluble sugars, so that once an aphid has succeeded in inserting its stylets into even a dormant bud it should have little or no difficulty in obtaining nourishment.

Nature of Injury.

There are two stages at which the aphid is injurious to the peach; (i) an early stage, when buds and blossoms are injured; and (ii) a later stage, from which leaf and shoot injury result.

(i) *Bud and Blossom Injury.*—The young fundatrices which emerge from the eggs commence to feed shortly after hatching. They insert their stylets into the tender portion of leaf and flower buds to obtain nourishment. This feeding commences before there is any outward sign of bud movement. The action of a number of aphids feeding simultaneously on a bud inevitably restricts the normal development of the primordia. It has been shown by Dr. K. M. Smith[2] that in feeding on the foliage of potato plants, *M. persicae* causes very little mechanical damage to the tissues with its stylets, but that the effects of the salivary secretion which the aphid injects into the tissue are considerable. This secretion dissolves the middle lamellae of the cells and causes plasmolysis and general disorganization of the contents of cells adjacent to the stylet track.

By the time that the flower buds are opening the fundatrices have reached maturity, and have already produced a number of young. As soon as the blossoms open sufficiently these aphids enter them and feed on the various organs (the stamens, styles, ovary, corolla cup, &c.), frequently resulting in the destruction of the fruit embryo. The young fruits themselves may be attacked, especially in the case of nectarines. It is not known exactly how far the destruction of buds, blossoms, and young fruits operates in bringing about a general lessening of crops in an outbreak year, but it is certain that this type of injury does occur.

(ii) *Leaf and Shoot Injury.*—Leaf development does not take place to any great extent until blossoming is over. After the completion of blossoming the leaves are the chief source of food supply for the aphid, and a heavy infestation soon becomes evident by the characteristic distortion of the leaves.

Under plague conditions, the feeding of the aphid harms the tree in a number of ways. Firstly, normal development of the leaves is considerably hampered, and leaf processes are interfered with. Secondly, arising as an effect of the leaf injury, the young twigs which are to bear the following season's fruit become stunted and distorted, and a high proportion of them may die. At this stage, trees may be almost completely defoliated. In the dormant period, a tree which had been heavily infested by the insect in the previous spring is distinguishable by the number of bent and twisted laterals which it carries on its branches. Under severe conditions (e.g., of 1928 outbreak) the upper portions of numerous branches of peach trees are killed outright. Thirdly, there is the total effect of these injuries on the future productivity of the trees. Apart from the death of laterals and branches which would bear fruit in future years, the interference with the normal functions of the leaves probably affects the initiation of fruit buds for the following season's crop. Thus it is evident that the cropping of a tree is affected for a longer period than the season in which it is attacked.

The autumn forms of the aphid (winged migrants and wingless, egg-laying females) apparently cause no injury to the old leaves on which they feed.

Plate 1.—Eggs of M. persicae at side of bud on peach lateral.

Host Plants.

M. persicae has been recorded on the following plants in Victoria:—

Primary Hosts.—*Prunus persica* (peach), *Prunus laevis* (nectarine), and, occasionally, *Armeniaca vulgaris* (apricot), and *Amygdalus communis* (almond).

Secondary Hosts.—Beta vulgaris (beet), *Cerastium vulgare* (chick weed), *Datura stramonium* (thorn apple), *Malva rotundifolia*

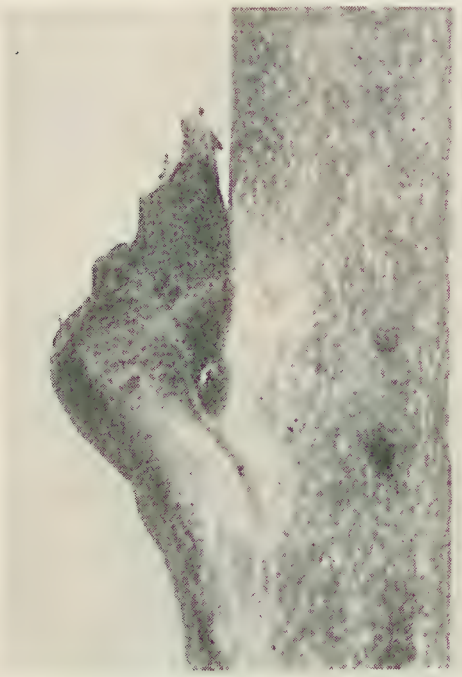


Plate 2.—Egg in pocket formed at union of bud and stem of lateral.

(marsh mallow), *Portulaca cleracea* (common purslane), *Rumex crispus* (dock), *Solanum tuberosum* (potato), *Solanum lycopersicum* (tomato), *Solanum nigrum* (nightshade), and *Sonchus cleraceus* (sow thistle).

LIFE HISTORY STUDIES.

A.—Field observations on life-cycle.

The activities of the aphid have been studied in the field almost continuously during 1930, 1931, 1932, and 1933, in both the Goulburn Valley and southern Victoria. The aim has been to ascertain the normal life-cycle through the year, special attention being paid to the times of the year when changes in habit occur, and to the actual duration of the different activities.

The life-cycle of *M. persicae* in Victoria is shown diagrammatically in Fig. 1.

Oviposition.—This occurs during late autumn. Eggs are deposited singly, the majority on laterals produced during the previous growing-season, and numbers in crevices, &c., in the bark. On the laterals each egg is placed in a sheltered position at the side of a dormant bud (Plate 1) in the small pocket formed at the union of the bud with the stem (Plate 2), or among the several buds at the apex of the lateral (Plate 3), rarely in an exposed position. The process of depositing the egg occupies from 15 to 20 minutes. As the egg passes out from the egg-passage of the aphid it is coated with a wet, sticky secretion from the colleterial glands, and this, on drying, securely gums it to the surface on which it is deposited. Each egg is light green in colour at first, gradually changing through darker greens to a shining black in the course of three to four days. It remains in this state until hatching. From field observations, the duration of the egg stage is approximately 55 days.

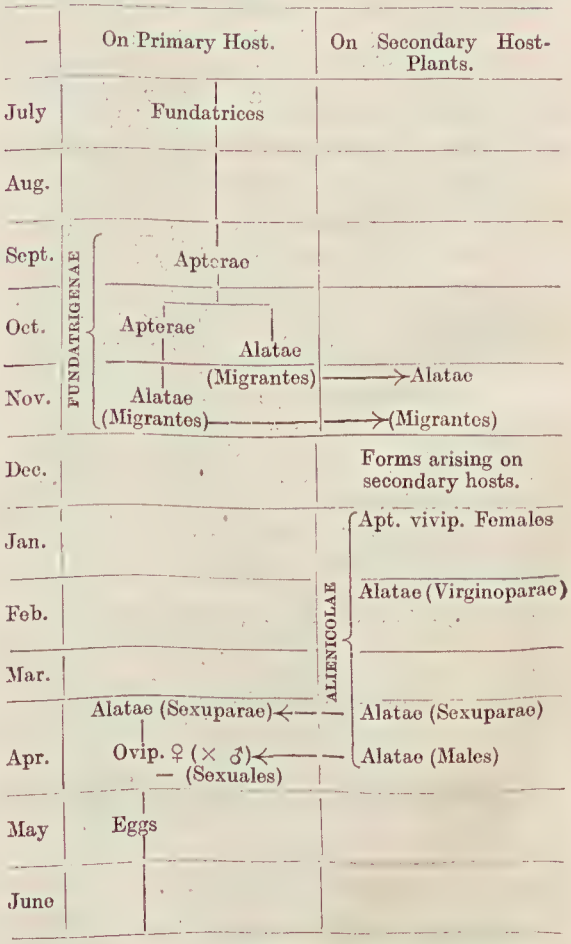


Fig. 1.—Showing normal life-cycle of *Myzus persicae* in Victoria.

Apterae = Wingless forms. Alatae = Winged forms.

The Fundatrices.—These emerge from the eggs, which hatch during a period covering midwinter and early spring. These forms develop into apterous, viviparous, parthenogenetic females. The larvae are green in colour, invariably a darker green than those of later generations. They feed at first on unopened buds, and their development to the adult stage is slow.

The Fundatrigenae.—These comprise the progeny of the fundatrices, born and developed

Plate 3.—Eggs at apex of peach lateral.

to maturity on the peach. They consist of the apterous, viviparous females, and the winged viviparous females, the latter being the migrants. The progeny of the fundatrices (second generation) are invariably apterous. They feed on the blossoms, opening leaf buds, very young fruits, and, later, on the young leaves. It is noticeable that development from larva to adult is more rapid than in the preceding generation, and it is at this stage that the characteristic harmful swarming on the young portions of the tree takes place.

By the time that the third generation has developed, growth on the host plant is considerably advanced, and feeding is restricted to the leaves and shoots. In this generation winged forms of the aphid (spring migrants) begin to arise, and in later generations increasing numbers of migrants are produced until all adult aphids are winged. It is at this stage of the life-cycle that a complete change occurs in the feeding habits of the insect. Following a migratory flight from the primary, woody host it commences to feed on secondary host-plants, which are herbaceous. In the first half of their life the migrants feed on peach trees, but in the second half they feed and reproduce on herbaceous plants (e.g. weeds). Their progeny carry on the life-cycle of the species on the secondary food-plants.

At the time of the year that this migration is taking place (approaching mid-summer) changes are occurring in the growth conditions of the peach, notably in the laterals. Here, the formerly succulent tissue at the growing points becomes "drier" and more woody, fewer young leaves arise, and those already produced have lost much of their succulence. These physical changes are, no doubt, accompanied by a change in sap constitution, and, as a whole, they must constitute an important factor in influencing winged production and inducing migration. The effects of length of day, temperature, and over-crowding on the food plant are also of great importance in this respect (cf. Davidson[3]). In addition to these factors, the migratory habit is inherent in the species under natural field conditions in Victoria.

The Alienicolae.—These are initiated by the spring migrants on the secondary food-plants. The descendants of the winged migrants may be (i) apterous viviparous females, (ii) winged viviparous females (virginoparae), (iii) sexuparae, i.e., winged viviparous females which produce the sexual oviparous females, or (iv) winged males. The virginoparae which may arise during the summer months are simply dispersal forms which distribute the species to new food-plants. The winged males do not arise until the return migration to the peach is about to take place.

The occurrence of these various forms on the secondary host plants depends, as has been

Plate 4.—Colonies of mature egg-laying females and their winged parents.

pointed out by Davidson[3], upon environmental factors, particularly overcrowding, and the condition of the food plant (nutrition). Thus local overcrowding might occur on some of the summer food plants, resulting in the production of winged forms, while elsewhere this might not take place. For this reason, the order in which winged and wingless generations might occur under insectuary experiments, is not necessarily the same as that which occurs in the field. Davidson has shown that under suitable conditions the parthenogenetic alienicolae generations of *Aphis rumicis L.* might be experimentally maintained for long periods. According to Uichanco, Slingerland reared *M. persicae* parthenogenetically for 62 generations over a period of two years ten months.

The last generation of the alienicolae comprises the sexuparae and winged males, and these forms make a return migration to the peach in autumn. First of all, the winged viviparous females commence the flight from the summer food plants, and while feeding on the peach they give birth to the sexual oviparous females. The winged males do not make their appearance on the trees until later on, at about the time the first of the oviparous females are nearing maturity. Thus, the migration of the males from the summer food plants does not commence simultaneously with that of the females, but at a slightly later period. Once the migration of the males has commenced, the general migration of both the males and females may be simultaneous for another two or three weeks.

There is evidence that a decrease in the numbers of aphids on the food plants occurs during the mid-summer months. Colonies of the insect are not easily found, they are small in size, and only a few immature forms are found associated with the adults. It is evident that reproduction decreases during the high temperatures of mid-summer. Weed[4] shows that reproduction in *M. persicae* is inhibited considerably above 80 deg. F. Conditions for several weeks prior to the autumn

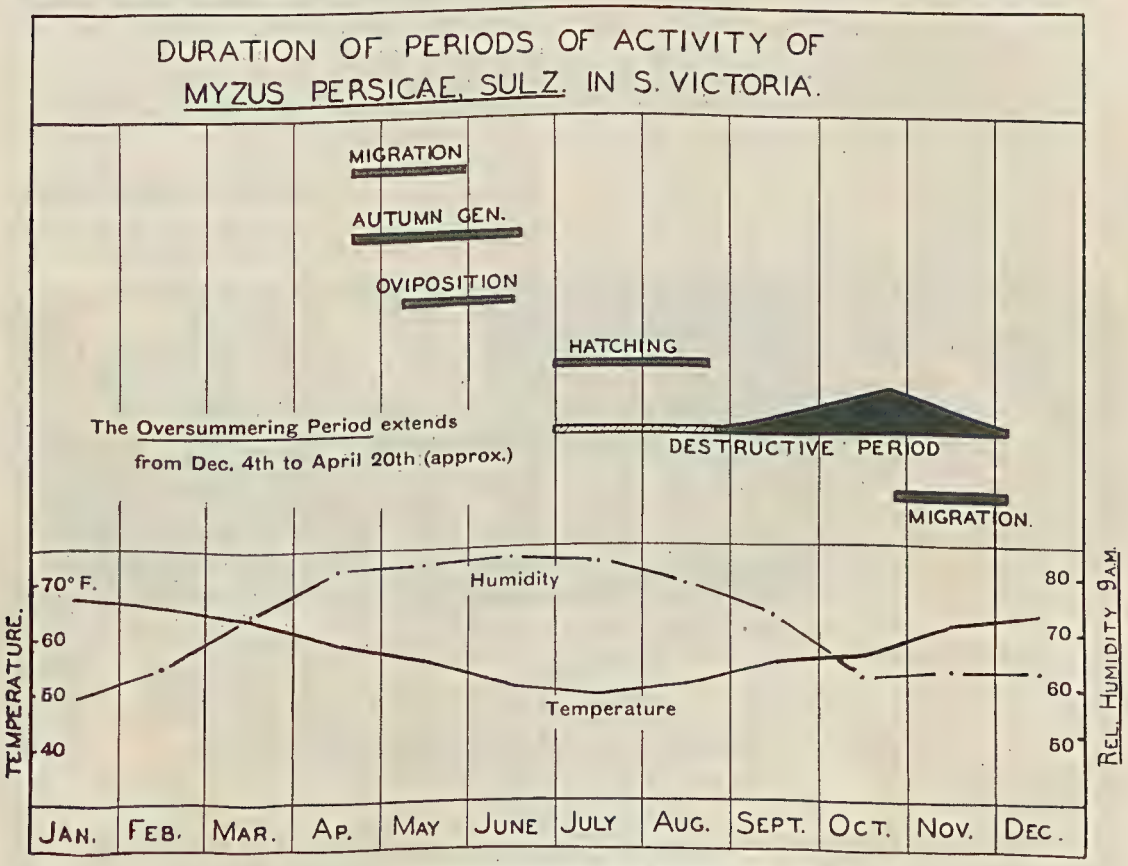
Plate 5.—Large number of colonies of autumn forms on peach leaf.

migration favour a corresponding increase in numbers of aphids on the summer food plants. This is due largely to more suitable temperatures and greater availability of food.

Autumn Generation on Primary Host.—The autumn migratory flights are made probably over short distances only. Indications of this are seen in the distribution of the migrants on a large block of peach trees at the peak of the migration period. Rows of trees adjoining headlands, irrigation channels, paddocks, &c. (where secondary host plants grow throughout the summer) always carry a higher population of these forms than the trees further removed from these regions. After oviposition has ceased, it has been found that trees near the centre of a block carry fewer eggs than those near headlands, &c.

The autumn migration occurs at a time when most peach varieties have lost more than half of their leaves. The migrants feed generally on the upper surface of the leaf, many of them near the midrib. Plate 4 shows several colonies of mature oviparous females with their alate (winged) parents. A common feature among these forms is the formation of small, localized colonies, which remain stationary over periods of one or two weeks. In colonies which have arisen from one parent the average number of individuals is ten, but there may be eighteen or more in a single group. At Burnley, during the autumn of 1932, it was common to find a large number of alate forms with their progeny on one leaf. In one case a leaf carrying 34 alatae had a total population of 220 individuals. Another leaf had 78 alate forms, and a total population of 510. A typical leaf with an association of the sexuparae and their progeny, together with the exuviae, is shown in Plate 5. While the great majority of these autumn forms feed solely on the leaves, on some occasions an alate migrant and her progeny have been observed feeding on the buds after the leaves have fallen.

The colour of the mature oviparous female is ferruginous red. They closely resemble the



Graph 1.—Duration of periods of activity of M. persicae in southern Victoria.

colour of the laterals and leaves on which they feed, and are thus not readily seen. Copulation between the apterous, oviparous female and winged male usually takes place on the laterals. This is the only stage in the complete life-cycle at which the male appears.

B.—Duration of Periods of Activity.

During 1931 and 1932 accurate records were made of the dates on which changes in the activity of the insect occurred at the Burnley peach orchard. These dates have, of course, an important and direct bearing on the times of application of spray materials when considering the adoption of control measures.

The observations made from this point of view are summarized in Graph 1, which shows the times of the year at which the different activities occupy, together with the averaged monthly temperatures and humidity for the two years. The averaged dates are as follow:—

Autumn migration, 20th April to 30th May.
Autumn generation on peach, 20th April to 18th June.
Oviposition, 5th May to 16th June.
Hatching, 28th June to 23rd August.
Destructive period, 28th June to 4th December.
Migration (summer), 28th October to 4th December.
Over-summering period, 4th December to 20th April.

An outstanding feature of the data obtained is the unexpectedly short interval of time which elapses between the end of the oviposition period and the beginning of the hatching period. Thus hatching commences about twelve days after the last of the eggs are laid, and actually before the minimum temperature has been reached (which usually occurs in the third week in July). In 1933 eggs were found to be hatching in the Goulburn Valley as early as 14th June, and at Burnley, 19th June. Thus, for three consecutive years hatching has been observed to commence before mid-winter. Therefore, although the majority of the eggs do not hatch until after this date, they cannot be described as "over-wintering" eggs. The fate of the larvae which emerge from eggs near the beginning of the hatching period has already been discussed. From Graph 1 it is seen that a period of about 7½ weeks elapses between the depositing of the first eggs and the commencement of hatching.

The destructive period begins probably a short time after hatching commences. The amount of injury which is caused to buds at this early stage cannot be extensive when compared with the damage which is caused later on. The most obvious and severe destruction begins about mid-September, and by the third week of October the aphid is at the peak of its activity on the peach. A few winged forms arise usually during the last week in October, and the exodus from the peach commences. Winged forms were observed developing on the trees as early as 1st October, in 1933, and the spring migration commenced a few days later. This is apparently unusual, since the earliest date on which the summer migrants occurred during the three previous seasons was 23rd October, in 1931. By the second week in December the migration is usually complete, and the trees are free from the insect.

The over-summering period, in which the aphid occurs only on secondary food-plants, extends from early December to the 3rd week in April, when the activity on the peach recommences with the autumn migration.

(*To be continued.*)

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Index to *Journal of Agriculture* for 1933

The Index of the Journal for 1933 has now been printed, and copies may be had on application to the Department of Agriculture.

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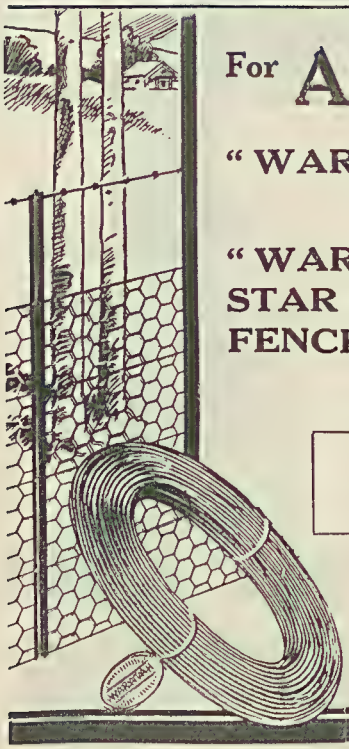

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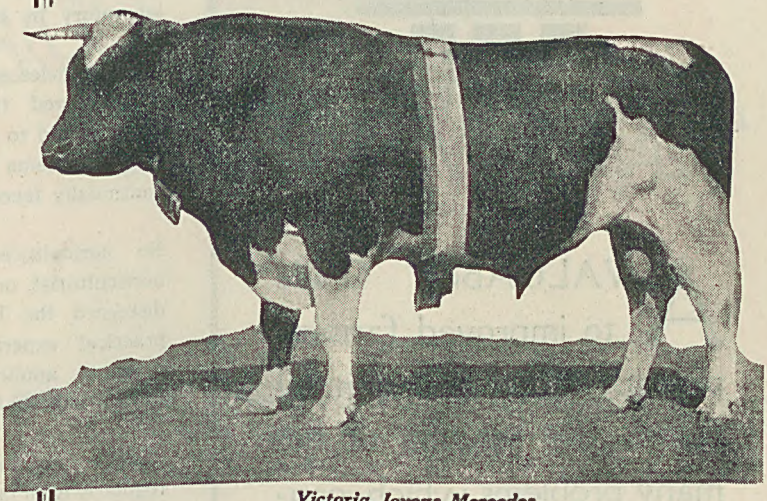

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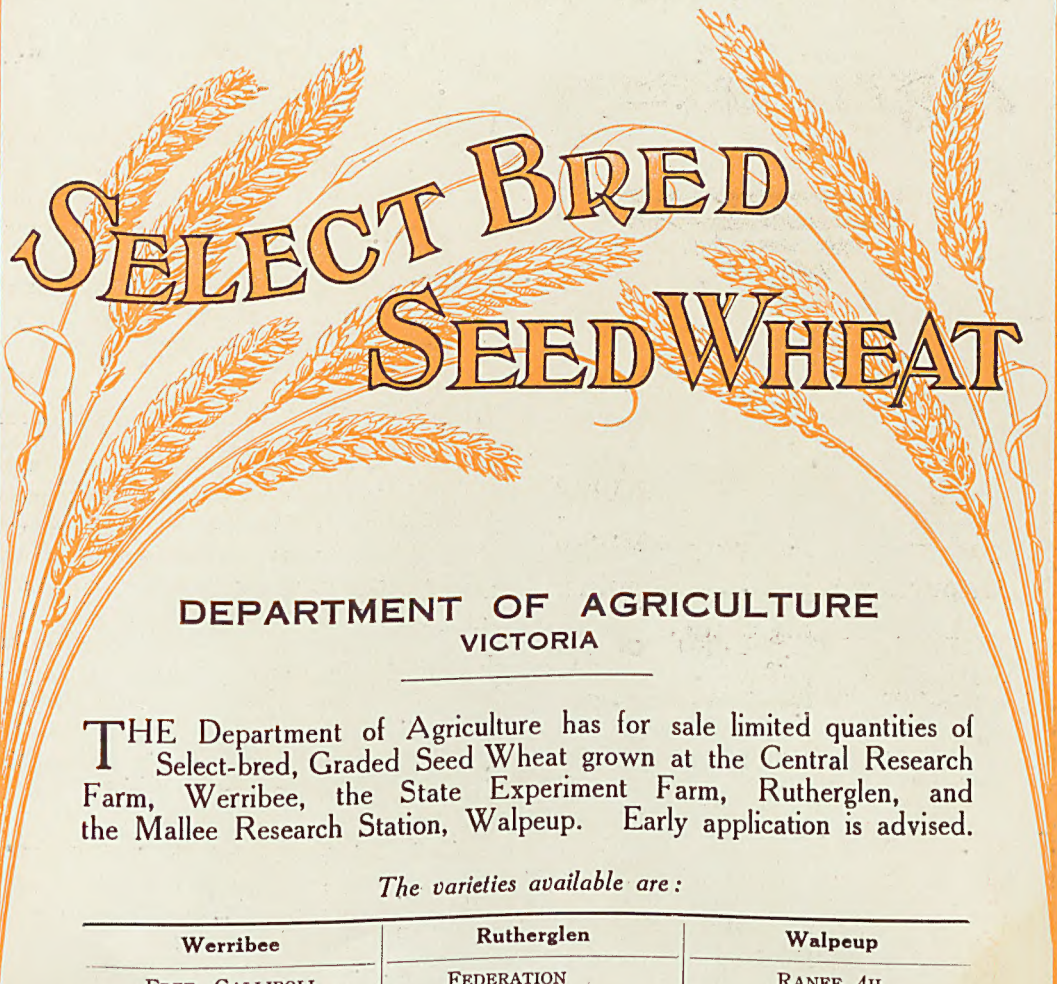

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